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Report of the

**TECHNICAL CONSULTATION
ON STOCK ASSESSMENT
IN THE EASTERN MEDITERRANEAN**

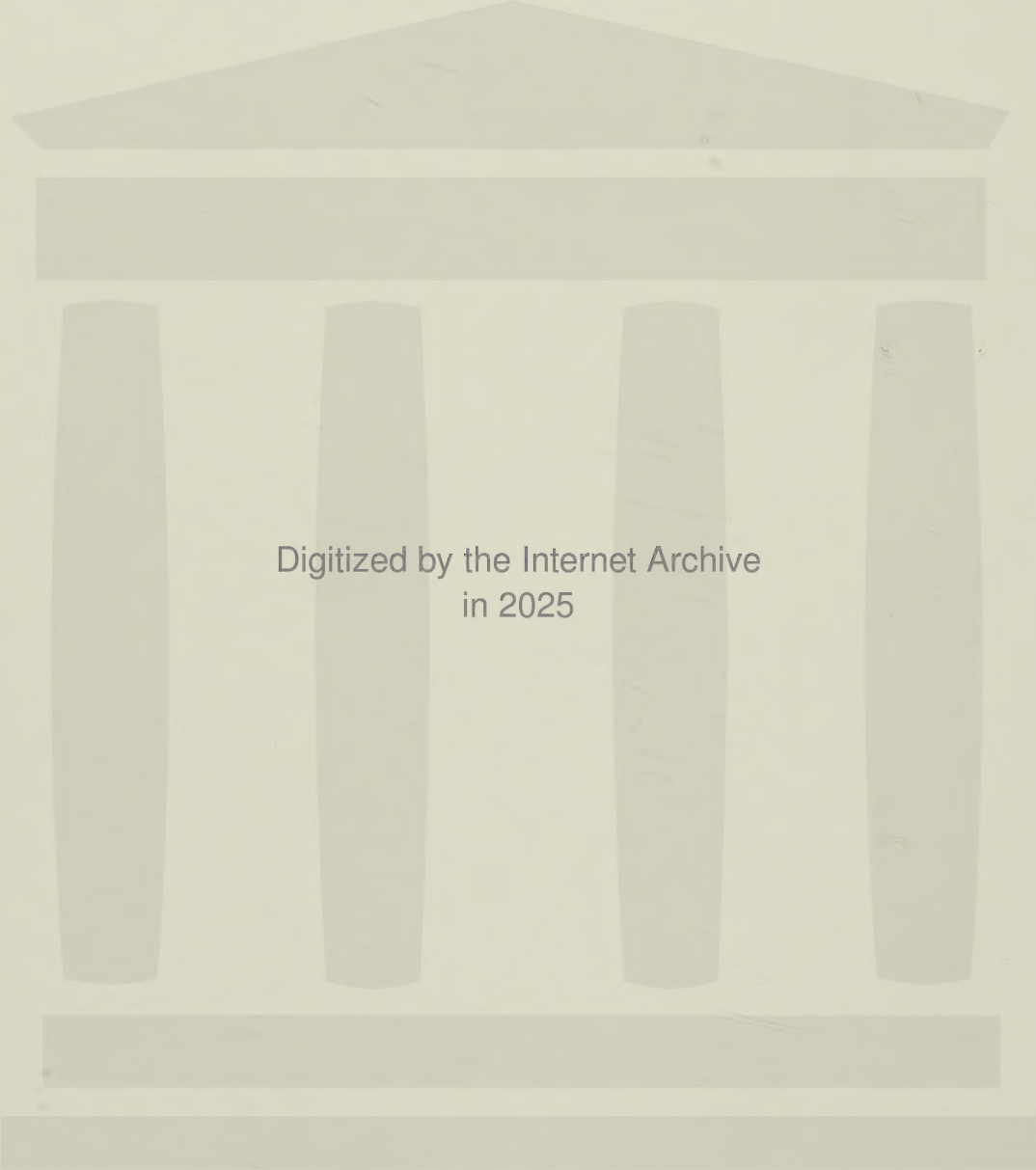
Rapport de la

**CONSULTATION TECHNIQUE
SUR L'ÉVALUATION DES STOCKS
DANS LA MÉDITERRANÉE ORIENTALE**

Rome, 7-10 April/avril 1986



**FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
ORGANISATION DES NATIONS UNIES POUR L'ALIMENTATION ET L'AGRICULTURE**



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REPORT OF THE TECHNICAL CONSULTATION
OF THE GENERAL FISHERIES COUNCIL FOR THE MEDITERRANEAN
ON STOCK ASSESSMENT IN THE EASTERN MEDITERRANEAN

Rome, 7-10 April 1986

RAPPORT DE LA CONSULTATION TECHNIQUE
DU CONSEIL GENERAL DES PECHEES POUR LA MEDITERRANEE
SUR L'EVALUATION DES STOCKS DANS LA MEDITERRANEE ORIENTALE

Rome, 7-10 avril 1986

Edited by/Edité par

D. Charbonnier and/et J.F. Caddy

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
ORGANISATION DES NATIONS UNIES POUR L'ALIMENTATION ET L'AGRICULTURE
Rome 1986

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PREPARATION OF THE PRESENT REPORT

The present text is the final version of the report approved by the GFCM Technical Consultation on Stock Assessment in the Eastern Mediterranean at its First Session.

The bibliographies in the annexes are as presented by the authors.

PREPARATION DU PRESENT RAPPORT

Le présent texte constitue la version définitive du rapport que la Consultation technique du CGPM sur l'évaluation des stocks dans la Méditerranée orientale a approuvé à sa première session.

Les bibliographies des annexes sont telles que présentées par les auteurs.

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SUMMARY

The meeting reviewed the data available on the fisheries of the sub-region and on the biological and dynamic parameters of the main stocks. It also discussed problems raised in stock assessment and considered some possible research approaches. Coordinated research programmes were suggested on some aspects of the biology of key species and on standardization of fleet statistics; the results will be reviewed at a second meeting suggested to be held towards the end of 1987.

RESUME

La réunion a passé en revue les informations disponibles sur les pêcheries de la sous-région et sur les paramètres biologiques et dynamiques des principaux stocks. Elle a également discuté les problèmes que soulève l'évaluation des stocks et envisagé d'éventuelles recherches d'approche. Les programmes de recherche coordonnés sur divers aspects de la biologie des espèces les plus importantes et sur la normalisation des statistiques des flottilles ont été suggérés; les résultats en seront examinés lors d'une deuxième consultation prévue vers la fin de 1987.

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I. INTRODUCTION

1. The Technical Consultation on Stock Assessment in the Eastern Mediterranean took place in Rome, FAO Headquarters, from 7 to 10 April 1986.
2. The participants (their list constitutes Annex B) were welcomed by the Secretary of GFCM on behalf of the Director-General of FAO.

II. ADOPTION OF THE AGENDA

3. The Agenda reproduced in Annex A^{1/} was adopted.

III. ELECTION OF THE CHAIRMAN

4. Mr A. Ben Tuvia was elected Chairman of the Consultation.

IV. DESCRIPTION OF THE MAIN FISHERIES

A. Fleets and Gear

5. The Consultation discussed the composition of national fleets with respect to vessel size, predominant gear type and the division between artisanal and industrial fisheries. Although the latter distinction can only be imprecisely defined, with some exceptions the industrial fleet corresponds in the Eastern Mediterranean to trawl and purse seine fisheries. A high degree of flexibility seems characteristic of most fishery fleets in this area, by species and season, making classification based on vessel characteristics alone not sufficient in itself for essentially multi-purpose fishing vessels.
6. A brief characterization of national fleets follows, which can be amplified in several cases by reference to the national reports in the Annexes C to G.

Cyprus (Annex C)

7. The distinction here is between an industrial fleet consisting of trawlers (10 boats at 57-93 ft OAL; 180-600 HP, built between 1955 and 1964 - but in good mechanical repair) some of which fish for part of the year in international waters off the coast of Egypt, and an artisanal fleet concentrating mainly on set and trammel nets and longlines. Except for the swordfish fishery (mainly artisanal), an industrial fishery for pelagics is not represented. The fleet of 477 boats range from 8 to 42 ft in length, of which a high proportion of boats and fishermen are part-time or occasional (but sell their catch on the market).

^{1/} The list of annexes is found in the Table of Contents, pages vii and viii

Egypt (Annex D)

8. There are approximately 1 420 boats, from 10 to 230 HP (mostly below 70 HP) belonging to 15 fishermen's cooperatives. These produce 20 000 t of fish, from three regions on the Mediterranean coast: that from Alexandria to Port Said having the most fishing vessels and receiving most fishing effort, by a combination of gear, including demersal trawling, beach seines, drift nets, trammel nets, long- and hand-lines and purse seining.

Israel (Annex E)

9. Apart from a distant-water industrial fleet operating outside the Mediterranean, the boats operating along the Israeli coast have a maximum size of 27 m (300 HP), but are not usefully separated into artisanal and industrial vessels, although for statistical purposes a distinction can be made between inshore boats (less than 11 m with inboard or outboard engines), small purse seiners of 11-14 m and up to 80 HP, and 14-25 m trawlers of up to 300 HP. The fleet fishes with a variety of bottom trawls, purse seines, tangle nets and longlines. Trawls cannot be considered as entirely demersal in operation since high headline trawls have come into operation in recent years. This fishery may best be characterized as multi-purpose, since although vessel classification by predominant gear types is possible, a high degree of seasonal versatility is characteristic; for example, purse seining for up to four months may be followed by conversion to longlining or trammel nets for the rest of the year. There has been a strong trend towards diversification of trawl fishing gear over the last few years; for example, in the use of net drums for rapid conversion between alternate trawl configurations. Development work has also focused on reducing fuel consumption during fishing operations.

10. The use of modern echosounders on smaller inshore boats is also growing, allowing location of more productive fishing grounds. In the last few years, the number of activity of inshore boats have increased greatly.

11. Pelagic fisheries using 2 000-3 000 m long nets and mechanized handling (power blocks), employ small mesh nets for sardines, and larger mesh nets for small tunas, on a seasonal basis. Pelagic Engel trawls have been introduced for trawling close to bottom and modern polyvalent trawl doors which are fuel saving and easier to handle.

Greece (Annex F)

12. The Greek industrial fishery predominantly consists of very old trawlers: 20 percent being over 40 years of age; few of these are being replaced.

13. Since 1976, when access off the North African coast was terminated, the former distant-water fleet returned to the national waters of Greece, and is showing a reduced production per boat sustained largely by increases in unit prices for bottom fish.

14. The total number of boats involved in the coastal fisheries is approximately 9 800 of over 20 HP: an 11 percent increase since 1974.
15. Approximately 12 000-14 000 boats of less than 20 HP can be added to the above number, and a fleet of amateur fishermen, of some 20 000 boats, plus a continually diminishing number of unmotorized boats (784 in 1981) all operate coastally. The main gear are gill and trammel nets, longlines, trawls, traps and seines.
16. A fleet of seiners also operates in Greek waters - of 11-20 m; 50-400 HP; of two types: night and day operations.
17. The total fleet tonnage has been constantly increasing (seiners and trawlers), partly as a result of the freeing of fish prices in 1979.
18. Mid-water trawling is forbidden in Greek waters.

Turkey (Annex G)^{1/}

19. The Turkish fleet fishing the Aegean Sea (1 342 boats) and Mediterranean (887 boats), are predominantly small-scale and coastal in operation, the majority being below 20 HP motor size. Fishing gear consists mainly of small trawls, longlines, gillnets and trammel nets. A few purse seiners operate in Mersin and Iskenderun Bays. Mid-water trawling has to be licensed by local authorities in Turkish waters. In the winter period up to 20 purse seiners come from the Black Sea especially to fish Enez Bay, fishing for migratory blue fish - Atlantic bonito, horse mackerel and anchovy.

20. The migration of boats on a seasonal basis may occur, especially for swordfish, between the Black Sea and the Mediterranean. This complicates the already difficult task of fleet enumeration caused by the long coastline and isolated landing points.

B. Sub-regional approach to vessel standardization for statistical purposes

21. The need for some uniform approach to classification of fishing vessels emerged from discussion in the Consultation; it should preferably be done on a uniform basis for the whole Eastern Mediterranean. Classification by horse power and/or boat dimensions can only be regarded as a partial basis for classification, and perhaps not the most important one, although for some (e.g. fiscal) purposes information on size and horse power may be necessary in an updated national fishing boat registry. Predominant fishing method should perhaps be the first classification; and principal fishing boat categories suggested are:

- gillnetter,
- longliner,
- purse seiner,
- trawler.

1/ The following document was also presented to the Consultation: The state of Turkish Mediterranean fisheries, by F. Bingel, METU, Institute of Marine Sciences, İçel

Possibly with secondary sub-categorization by size/HP, and where such data are available, by secondary gear type, and by main species sought by each vessel/gear combination.

22. This discussion led to the proposal that fishing vessels in the region should be classified for statistical purposes under a standardized system according to the main fishing method employed. The Consultation charged Mr Grofit to prepare a suitable reporting form for this purpose, to be circulated by the Secretariat in the countries of the Eastern Mediterranean, for comments and approval.

C. Fisheries regulations and enforcement

(a) Vessel licensing

23. Regulations limit the number of trawlers in the Cyprus fleet but not the number of smaller boats.

24. A licensing system is applied by the Ministry of Transport in the Egyptian fishery but no limit on number of licences applied, though fleet statistics are maintained.

25. In Greece, there is no limited entry to the fishery, in the sense that there is no fixed number of boats in the fleet. We may note, however, that the issue of new trawler licences has been suspended since 1985. Since 1977 the fleet has had to use a significant number of former distant-water industrial fishing boats. An operator must be a fisherman in order to be able to build or purchase a new vessel. Fishermen in the artisanal fishery must be licensed individually, and for the industrial fleet, the licence is on the boat.

26. No licence limitation scheme applies in Turkey, though investment in larger boats is controlled.

27. Licensing of vessels in Israel is by the Ministry of Transport. Every fisherman has to be licensed by the Department of Fisheries. Skippers of vessels are also required to hold special licences depending on the size of the vessels. The intention of present regulations is to maintain the current fleet size, given that it appears to be associated with a more or less stable level of landings; and licence in future will be by fishing method, season and location. A limit on the total trawler fleet/horse power has also been proposed.

(b) Size limits and mesh-size regulations

28. In Cyprus, the stretched mesh size of 34 mm is justified as necessary to harvest Spicara maena, a small, slender fish which apparently escapes through 40 mm mesh. There is serious concern, however, that incidental catches of immature Mullus and Pagellus in this fishery may affect spawning potential of these species, and a number of formerly abundant species are less common, or smaller in size.

29. In Egypt, no mesh-size regulations are in effect at present, and very small mesh sizes are used in some fisheries.

30. In Greece, attempts are being currently made to increase the present mesh size in trawl cod ends, and marketing of fish of less than 8 or 10 cm is prohibited. This poses a serious problem in the hake fishery in that discarding of small fish at sea results at some times of the year (70 percent of the hake catch consists of one year and younger).

31. In Israel, which has no fishing gear manufacturing industry, mesh size is mainly controlled by restrictions on gear dimensions imported, which is easy to control. Red mullet was the standard species used for deciding on this mesh size in cod end of trawls, which corresponds to 50 percent retention of individuals below 110 mm (which nowadays, however, form a relatively small proportion of the catch). There are obvious problems, however, in standardizing on one single mesh size for a multi-species fishery, although in Israel the higher price paid for larger fish and the minimum legal sizes at marketing mean that mesh-size control is not the major problem: the market regulates the effective minimum size, and minimum legal sizes do not need to be heavily enforced. This is not the case in the other countries, however, in particular Egypt, Cyprus and Greece, where a significant part of the catch consists of small fish.

TABLE 1

Minimum mesh-size regulations
in the Eastern Mediterranean

<u>Country</u>	<u>Trawl cod end</u> <u>(stretched mesh size)</u>	<u>Beach seine</u>	<u>Purse seine</u>
Cyprus	34 mm		
Egypt	No regulations*		
Greece	28 mm		
Israel	48 mm		20 mm
Turkey	40 mm	36 mm	

* 18 mm stretch is normal mesh size

(c) Other fishery regulations

32. In the Eastern Mediterranean, questions determining the access of industrial and artisanal fleets to the near-shore fishing grounds and to nursery areas in critical habitats such as estuaries, lagoons and shallow waters are of major concern. Actual or potential conflicts between different sectors of the fleet exist in several countries, and have been tackled by differential seasons and access rules. Administrations are thus taking different approaches to resolving the problem of both conservation and of access, but not in general controlling fishing effort or landings (quotas). The Consultation expressed the need for

an exchange of information on the effectiveness of the various measures in force, and in particular, recommended that areas of importance for early recruitment of important species (nursery areas) be identified on a priority basis for the main species.

33. In Cyprus the industrial trawl fishery is restricted to depths greater than 30 fathoms. A fishery protection service with three patrol boats is responsible for at-sea surveillance. Patrols are carried out twice weekly. The four months seasonal closure for the industrial trawl fleet was extended into October in 1981 to protect young of the year entering the fishery from heavy fishing. This regulation may be responsible for increased catches in the last two years. No regulations apply, however, to the artisanal fleet.

34. In Egypt there are no seasonal closures in effect. But no fishing within 2 km of river mouths is allowed. No fishing near the Libyan frontier is allowed.

35. Area prohibitions, such as fishing near estuaries and trawling inside two miles of the coast (reserved for stationary gear) apply in Israel, though this last regulation is rarely enforced, given that shrimp grounds are close inshore on a narrow shelf. Reserved areas for inshore fishing with static gear have been proposed. At present there is no seasonal trawl closure.

36. In Greece, the seasonal closures on the trawl fleet are intended to protect juvenile bottom fish in the summer months. Some bays and gulfs are closed for trawling over a longer period. No trawling is allowed within one mile from the shore, and two miles from river and lagoon mouths.

37. In Turkey, there is no trawl-closed season, although a closure of inshore seining is applied in early summer. Trawling is prohibited inside three miles of the coast.

38. A list of seasonal closures by country is given in Table 2.

TABLE 2

Seasonal fishery closures in the Eastern Mediterranean

<u>Country</u>	<u>Gear</u>	<u>Closed season</u>
Cyprus	Trawl (industrial fleet)	June-October (incl.)
Egypt	-	No closure
Greece	Trawl (industrial fleet)	June-Sept. (incl.)
Israel	-	No closure
Turkey	Seine fishery in coastal areas	1 April - 15 May

D. Data available on catches by fishery and sector

(a) Statistics collection and government infrastructure

39. In Cyprus data on landings (logbooks) are collected from the industrial fleet by a team of two-three officers from the District Office and are

computerized. The data base for the artisanal fleet is sampled on a less regular basis. Data on fishing effort and catch per unit effort are computed in the Statistics Section.

40. The number of species present in the demersal catch has declined by about 20 percent over the last decade, and the mean size for some species has also declined, e.g. mullets. The possibility was suggested for Cyprus landings, of comparing landed catch by species against research vessel catch, in order to obtain an index of exploitation rate by species.

41. In Egypt, landings are made at nine main fishing ports on the littoral of the Mediterranean Sea and data are collected by a team of fisheries inspectors from a fleet of 1 421 fishing boats. Fifty percent of the fleet is under 50 HP and works within 1-2 miles of the shore, using a variety of gear, including handline, beach seine, drift net, purse seine, trammel net and longline. The rest of the fleet consists of purse seiners and trawlers, and works inside 150 m depth. Total marine catch is 20 000 t (not including lagoons) annually. A bulletin of statistics is published annually in Arabic. The coastguard checks time at sea for the larger boats. Biological sampling started recently; particularly for size frequency and stomach contents. No data on fishing effort or catch rate are collected, though estimates of 16 kg/hours trawling for trawl catch rate were available, and for purse seine 486 kg in 24 hours, and for other gear 75 kg in 24 hours.

42. Recently the R.V. FRIDTJOF NANSEN has surveyed the Mediterranean waters of Egypt for species abundance.

43. A long series of landing data collected by the local customs authorities exist for Greece, with the exception of 1939-64 when no data were collected, and an annual report on landings is published two years afterwards. Catches are obtained by species for each of the sixteen statistical areas. No data are collected on fishing effort or catch per unit effort, but catch per month figures may be available. Data are now being collected for several species on length frequency of the catch, by the National Centre for Marine Research.

44. In Israel a computerized monitoring system allows the calculation of catch per hour and per day by trawlers on a seven times daily basis, by radio, for a grid system in each of eleven fishery statistical areas. For the trawl fleet, therefore, catch and fishing effort figures could be obtained in detail. The average trawler fishes 200 days per year, catching 20 kg/hour of trawling.

45. Landings for the purse seine fleet can be obtained at canning plants on the basis of fishermen's contracts since 90 percent of landings go to companies. For the growing inshore fleet statistics are more difficult to get, and are obtained by indicative sampling of several boats, with a fairly wide (20-30%) margin of error.

46. No biological sampling for length or spawning condition occurs, but systematic sampling at all seasons/depths for Merluccius has been carried out for size frequency and stomach contents, although the processing of the data is not yet complete.

47. The shortage of manpower for sampling poses a problem: there are three fishery inspectors whose jobs include enforcement and licensing, as well as the collection of statistical data. Despite the absence of specialized statistical staff, an annual bulletin is published.

48. In Cyprus statistics are collected separately by industrial and artisanal fisheries, by district officers who collect logbooks signed daily from trawl skippers. Trawl fishing statistics are being computerized starting this year.

49. In Egypt in 1985 total trawler HP is 111 732 with a catch of 11 400 t purse seiners from 18 720 HP total with 7 500 t catch. For other inshore boats a total of 10 790 HP corresponds to a catch of 2 068 t.

50. In Turkey in the last two years, the Ministry of Agriculture and the State Statistical Institute (DIE) have been collecting data together from local offices in every main port. Data are sent monthly to Ankara. Annual reports are published.

51. DIE also samples fish markets with Ministry of Agriculture officers, to determine the species composition landed locally.

52. Some doubts were expressed that these landings come from local grounds, since sections of the fleet move between the Aegean Sea and the Black Sea, but since freezing facilities on board do not exist, this is unlikely to affect greatly the local nature of landings. No data are collected on catch and catch rate, and apart from several university groups, no biological sampling has begun. A five-year programme of biological investigations and sampling will begin shortly.

(b) Future data needs for fisheries research

53. With the exception of Cyprus, where a research vessel occupies standard locations on a close-to-weekly basis throughout the year, weather permitting, there are no systems for the regular collection of standard catch rates by standard fishing gear, now in operation in the Eastern Mediterranean. The desirability of some sort of standard national system of monitoring resource abundance, particularly for the demersal species, and especially for recruitment, was discussed. Such systems might include stratified random trawl surveys giving a direct estimate of abundance, or standard transects or fishing stations in areas of commercial importance, or in areas of new year class (recruit) abundance, for fisheries prediction purposes.

54. It was suggested that fisheries administrations explore the possibility of setting up some system of monitoring abundance using a standardized fishing plan, either with commercial or research vessels, that will allow long-term monitoring of abundance changes for the key species; especially for demersals.

55. As a result of its discussion on this item, the Consultation recommended that each member country undertake to publish a yearly statistical bulletin in English or French and make it available to all research institutions of the Eastern Mediterranean and that, for statistical purposes, standard units of effort be used as follows:

Entangling gear:	catch per 100 m of hung netting per set
Longlines:	catch per 100 hooks per set
Purse seining:	catch per day or per hour searching time on the grounds
Trawl:	catch per hour by HP category (dimensions and type of trawl to be specified)

V. ESTIMATES AVAILABLE ON BIOLOGICAL AND DYNAMIC PARAMETERS FOR THE MAIN STOCKS

A. Growth

56. Because of the heavy fishing some resources are subjected to, relatively few older fish may be captured for some species. Fitting the growth curve in these circumstances, and especially where modal analysis of size frequencies is the method, may result in lower predicted K values, higher values of maximum size (L_{∞}), and large (negative) values of t_0 . Supplementing data series with scarce information for older fish, especially aged by otoliths, is one approach. Including mean sizes for $t < 1$ year is another.

57. Some progress is being made, especially in Cyprus and Greece, in research into growth and mortality rates of key fish species of commercial importance. Some of these are given in the annexed papers.

58. Estimates already exist for growth parameters by some countries: thus Cyprus has (von Bertalanffy) estimates and length/weight relationships for seven species, and five more are being studied. Greece has already submitted estimates for hake, red mullet, red pandora, gurnards and angler fish to the Fourth Adriatic Technical Consultation (October 1985) and to scientific journals.^{1/} Egypt is working on gilt head bream, and work is in progress in Israel on red mullets. Research is also going on in Israel on Penaeids (P. semisulcatus and P. japonicus) and most of this type of research in Israel, Turkey and Egypt is proceeding in the university sector; these workers could be usefully involved in future consultations.

59. Research approaches to age and growth studies have varied, but in general otolith reading has proved to be a successful approach, allowing the possibility, in combination with size frequency analysis, of developing age length keys.

60. The use of scales has been less successful and there have been some real problems with application of methods based entirely on size frequency analysis. These were discussed in the Consultation, and a number of general points emerged.

^{1/} See also Annexes H to L.

61. Because of heavy fishing on small individuals early in life, or on short-lived species, the importance of properly defining growth rate in the first two years is evident. The mean size at age should probably be followed at quarter-year intervals, using, where possible, small mesh sampling gear, so as to better define the size at first annulus formation. Noting that daily age rings have been successfully used for this purpose, the Consultation requested that Dr P. Walline investigate the use of daily growth increment techniques for identifying the first annulus on otoliths for several species of interest.

62. In conclusion, a combination of special size frequency sampling for young fish, and otolith reading of older individuals, may provide better values of von Bertalanffy parameters.

63. Dissatisfaction with the existing software for analyzing population trends was expressed by several participants: a considerable amount of time has been wasted, and effort duplicated, in trying to programme published methods. FAO is requested to aid in providing more satisfactory software.

64. The idea of an otolith exchange programme to compare procedures for age and growth estimation was agreed to, with Mullus barbatus and Merluccius merluccius being the principal species to be dealt with. Participating individuals initially would be:

<u>Country</u>	<u>Name</u>
Cyprus	R. Livadas
Egypt	M. Hegazy and N. Bollis (General Authority for Fish Resources Development)
Greece	C. Papaconstantinou
Turkey	S. Dincer, Sönger Araştırma, Merkezi, Bodrum
Israel	S. Pisanty, D. Golany

65. Numbered otoliths with corresponding fish length, sex place and date of capture, for a range of sizes, should be exchanged between participants, ages read for each numbered fish, and sent to the Secretariat for comparison. (Do not write ages on the material: the purpose is an independent comparison of methods of reading). Participants undertake to supply a list of workers on fishery biology and population dynamics to GFCM for distribution to other workers.

B. Mortality estimates

66. The Consultation discussed the problems of determining mortality rates of species which may show migrations (bathymetric and horizontally) throughout the life history; e.g. the likely migration of hake between the Adriatic and Ionian Seas. The need to sample throughout the stock range was stressed, which in practice may pose some problems given that our knowledge of the unit stocks involved is still rudimentary.

67. Such estimates as have been made, suggest that total mortality rates of close to $Z = 1$ may apply in some areas, e.g. red pandora in Greek waters, suggesting high exploitation rates, which in Cyprus waters also seem to rise continually with time. More information on age composition of sampled commercial and research vessel catches will be needed on a continuing basis to allow more sophisticated approaches, such as cohort analysis to be used, as has been attempted in Cyprus.

68. A problem was expressed by the Technical Secretary, with the relatively low values of M , of the order of $M = 0.1 - 0.2$ being obtained, using methods that rely on statistical relationships between growth parameters and natural mortality rates. If low values for K , more typical of north boreal species, are obtained, possibly for reasons of bias in parameters estimates discussed earlier, thus will result also in low values of M , which of course affects the subsequent yield calculations.

C. Reproduction and recruitment

(a) Reproduction

69. Cyprus has been following gonad development using the 8 - point Maier scale ^{1/} sampling at 15-day intervals. Most species spawn in April-June in Cyprus waters, except hake, which seem to spawn all year round. Fecundity estimates have been made for some species.

70. In Egypt, grey mullet spawns in January-April, and also in July-November. In Greece, age at maturity and fecundity of hake have been studied, and here spawning occurs all year round - especially in February-March (Aegean) and November (Ionian Sea). Age at maturity begins at age 3-4 - full maturity occurring at a still later age. Red mullet and pandora spawn in mid-April/June; their first spawning coming at the end of the second year of life at 13-14 cm.

71. Because of partial spawning, defining the size at 50 percent maturity is difficult.

72. In Israel, age at first maturity of Sardinella is in the second year of life irrespective of size, followed by a very prolonged spawning.

73. In Turkey spawning date depends on area-wide ecological differences along an extended coastline. It is planned to collect data on size at spawning for about 10 economically important species starting in 1986, when the Ministry of Agriculture starts a five-year programme in support of stock assessment.

(b) Recruitment

74. In Cyprus, for most species, age at first capture begins at 6-7 months (7-9 cm with 32 mm mesh). No special nursery areas for young fish exist.

1/ Holden, M.J. and D.F.S. Raitt (eds.), Manual of fisheries science. Part 2. 1974 Methods of resource investigation and their application. FAO Fish.Tech.Pap., (115)Rev.1:214 p. Issued also in French and Spanish

75. Red mullet and red pandora nursery areas are close to rivers - the migration to deeper waters occurring in November.

76. In Israel, nursery grounds for red mullet are also known; they recruit to the fishery at 9 cm, maturing at 11-12 cm.

77. Cyprus started a recruitment survey in November 1985. Because of the small mesh size, 0-group fish are taken in cod ends of commercial gear. Biases in mean size at age may occur, however, if the small fish are only partially retained. The advantage of using special sampling gear to obtain quantitative samples was discussed: a small mesh beam trawl with 10 mm cod end has been successfully used for sampling juvenile red mullet and shrimp in Israel. Beach seines may, with care, also provide quantitative estimates of recruit abundance (e.g. for Sparidae and Serranidae).

D. Selectivity

Cyprus

78. Mesh selectivity trials were carried out in Cyprus in 1977 in connection with the GFCM Resolution on the 40-mm minimum stretch mesh size. Selection factors are available for 34 and 40 mm mesh sizes. There is a need to increase mesh size to 40 mm to save Mullidae which have become scarcer - only two-year classes now occur in the landings. Calculations of short-term losses from size increases were made. Spicara maena is the problem in increasing mesh size to 40 mm: a short-lived and slender fish spawning at age one; it is a protogynous hermaphrodite.

Egypt

79. No information on mesh selectivity exists at present.

Greece

80. The 28-mm mesh now in effect permits little selectivity. An EEC-financed study is now investigating this problem.

Israel

81. The 48-mm mesh now in effect makes good economic sense from Israel's experience. Mesh size alone does not dictate selectivity; however, double mesh (as in the shrimp fishery) and tightness of hanging determines effective cod-end selection characteristics.

82. The Technical Secretary pointed to the fact that although short-term losses occur in moving to a larger mesh, before the long-term benefits of increased fish size are experienced, the period of short-term losses in the Mediterranean is brief. For current low ages at first capture, it would for most species

involve a delay of less than one year before improved yield would be obtained because of the high growth rate of very young fish. One experimental approach might involve the closure of a small area (around an island for example) to fishing with small mesh gear for 2-3 years, to assess results.

E. Main demersal fish communities

83. In Israel, major changes in fish communities have been noted over the last 40 years, some of them with economic basis; e.g. the reduced catch of hake due to costs of deep trawling for a relatively low-priced fish. The other main effect has been the continuous addition of Indo-Pacific species through the Suez Canal at the rate of about one fish species every two years, some of them becoming commercially important. This has contributed to a special Levantine faunal zone, stretching from the Southern Aegean to Libya, where up to 30 percent of the present demersal fish catch such as Leiognathus and Saurida undosquamis and several commercially important shrimp were originally exotics.

84. From the limited data on catch by species presented, there seem to have occurred some dramatic changes in relation to abundance of species, particularly in the Cyprus landing figures, although it is not certain to what extent these represent natural species fluctuations or the effects of fishing. However, there are some indications from Cyprus that the diversity of species caught has diminished over the last decade.

85. An analysis of early Greek landing data (1928-39) suggests that marked landing fluctuations have occurred over the historical period, that are not all due to market preferences or changes in fishing techniques. In absence of time series of hydrographic data, which seem not to be available in the area, there appears to be a correlation between landing data and air temperature, which needs to be followed up by exploration of possible data sources and investigation of links between atmospheric climate, hydrography and biological production for the Mediterranean as a whole.

86. The other major fishery impact discussed in the past in the literature, related to the postulated effects of the Aswan dam on reduced flow of nutrients from the Nile delta, which formerly supported a flourishing sardine fishery. Some evidence now exists that this stock still exists but at different locations and depths than formerly, and is no longer as readily available as previously to fishermen, except by fishing with lights.

87. A dominance of some heavily exploited fisheries by short-lived species seems to be becoming evident. In Cyprus, the importance of Spicara maena for example has grown, and the higher catch of cephalopods in Greek waters over the last decade than in the 1930s are possible ecological indicators of high fishing intensity.

88. Some trophic studies have been carried out on several species in Greek waters, revealing that diet overlap for several key species is limited. No comprehensive food web studies appear to have been carried out in the Eastern Mediterranean.

89. A detailed knowledge of the characteristics and bottom type of fishing grounds exists in the fishing industry in most of the countries, each of which has a somewhat different fish community. Apparently preparation of maps of fishing grounds, such as completed in the Western Mediterranean, would not be impossible.

F. Discards

90. The situation with respect to discards in the Eastern Mediterranean is that these are relatively infrequent (except for unmarketable species) in the demersal catch, except for some seasonal discards, e.g. of juvenile hake and in November small red mullet (Greece); some red mullet and Boops (Egypt). Since the 48 mm mesh size was introduced, few undersized demersals are caught in Israel, although including unmarketable species; a figure of 20 percent discards was estimated for the trawl fishery. Use of discards for fish meal is generally not economic due to the small quantities. It may prove useful, however, to compare unmarketable species between countries, since species preferences seem to differ significantly.

91. For pelagics, considerable discarding occurs, especially where legal minimum sizes are in effect: as in sardine fisheries in Israel, Egypt and Greece.

92. A legal minimum size on landing or marketing which is greater than the 50 percent mesh retention size for the gear seems likely to lead to discarding practices, if enforced, and there is a real advantage to managing size at capture by means of size regulations, as in Israel.

VI. STOCK ASSESSMENT

A. Global production models

93. The Technical Secretary reviewed the methodologies currently available for modelling total production from the fishery as a function of fishing intensity or mortality. These models can either be used for multispecies or single-species assessment, but impose certain data requirements:

- the need for a standardized fishing effort series for a significant period of years, and
- the desirability of working with unit stocks or closed populations.

94. In recent years, composite production models^{1/} have been developed, that make use of simultaneous data from a series of unit areas with similar basic

^{1/} Caddy, J.F. and S. García, Production modelling without long data series. In 1983 National reports and selected papers presented at the Third Session of the Working Party on assessment of marine fishery resources of the Western Central Atlantic. FAO Fish.Rep./FAO Rapp.Pêches/FAO Inf.Pesca, (278) Suppl:309-13

productivity: comparing fishing intensity (effort/area) against mean catch rate. This approach has recently been used in the Western Mediterranean and was one of the main reasons for the development of a fishery atlas^{1/}. In the Eastern Mediterranean, the Israeli data would seem potentially usable in such a model.

95. Other variations of production modelling^{2/} use total mortality rate in place of fishing effort data, when this is not available.

96. Production models in general are also difficult to fit when fishing intensity is already high, and there were some doubts if they would be of general use, if pronounced fluctuations in production from year to year occur.

B. Analytical models

97. A start has been made in estimating the growth and mortality rates necessary for applying yield per recruit (Y/R) models, and an estimate of the relative impact of changes in fishing mortality and size at capture could already be made for several fisheries. Noting that: potential yield = $(Y/R) \times \bar{R}$ where $\bar{R}$ is average recruitment level, the importance of estimating recruitment level, especially when effort is high, is emphasized.

98. So far, no Y/R calculations have been reported on for the Eastern Mediterranean, but it can be predicted from results in other areas that these will reveal that increases in yield for many species will occur at higher sizes at fish capture and/or lower intensity of fishing.

99. The problem of yield overfishing described above (where less benefit is received from a given number of recruits than could be), is only one aspect of the problem. So-called recruitment overfishing is equally or more serious; namely, the reduced number of recruits resulting from fishing heavily before size at maturity.

C. Semi-quantitative approaches

100. Estimating production per unit area for different fishing grounds over the whole area can be useful in permitting the comparative approach to assessment on a Mediterranean-wide basis. This includes preparing maps showing bottom-type and area by depth, plus fleet fishing grounds, and estimating production (especially of demersal and commercial benthic invertebrates) per unit area of sea floor. In other areas, reasonably similar estimates are found for similar habitats.

1/ Charbonnier, D. et/y/and S. Garcia (eds), Atlas des pêcheries de la Méditerranée 1985 occidentale et centrale. Atlas de las pesquerías del Mediterraneo occidental y central. Atlas of the fisheries of the western and central Mediterranean. Rome, FAO, CGPM/GFCM, CEE/EEC, pag.var.

2/ Csirke, J. and J.F. Caddy, Production modelling using mortality estimates. 1983 Can.J.Fish.Aquat.Sci., 40(1):42-51

D. Research vessel surveys

101. The use of research vessel surveys to determine biomass directly is one alternative (or supplement), only used in Cyprus to date. A system of regular transects (giving relative changes in biomass from year to year), or stratified random surveys (estimating total biomass) are two alternatives. Recruit or pre-recruit surveys are often a separate priority.

VII. GENERAL CONCLUSIONS AND CRITICAL REVIEW OF ASSESSMENT METHODS AND RESEARCH PRIORITIES IN THE EASTERN MEDITERRANEAN CONTEXT

102. The discussion on item VI suggested the following priorities for application of assessment methods to Eastern Mediterranean stocks:

103. High priorities are:

(i) Sampling and analysis

Integrated collection of better data on catch by species and area, and sampling schemes for size and age for key species should be considered.

(ii) Semi-quantitative approaches

The preparation of national maps of fishing areas seems a necessary preliminary to detailed analysis. Such maps might show fishing zones by predominant bottom type, (seasonal) areas fished, number and location of ports and, for each port, number and type of boats and gear fishing.

(iii) The above approach may lead directly to application of composite production models.

(iv) A continuation of parameter estimation leading to application of yield per recruit model is desirable, with calculations for a range of parameter combinations where previous estimates do not yet exist. Age-length keys should be prepared as a basis for better sampling.

(v) Fecundity per recruit models promise to point impacts of current fishing patterns on future recruitment. Needed here are better estimates of data and age of spawning and recruitment, with ideally estimates of partial recruitment at size and partial maturity by season. The number of eggs produced per female would also be useful in calculating replacement rates.

(vi) Pre-recruit surveys should be given some attention if a research vessel is available.

104. Lower priorities are given to production modelling in general and to trophic studies, although university groups can provide useful inputs here.

VIII. PROBLEMS MET AND RECOMMENDATIONS FOR RESEARCH AND MANAGEMENT PRIORITIES

105. Although for one country, Israel, trawl catches appear to have remained fairly stable, suggesting that a close to MSY condition prevails, for Greece and Cyprus, despite increases in effort in recent years, landings may even have decreased, and some valuable species have become scarce. This situation points unambiguously to a degree of overfishing which is almost certainly economic as well as biological in nature, and has only been sustained (and promoted) by higher prices. Paradoxically, recently reduced fuel costs are likely to accentuate biological overfishing if licence limits are not enforced. For Egypt and Turkey, the situation is far less clear, and much basic work needs to be done in collecting the necessary biological and production statistics.

106. In general, priorities for future work on species will have to be concentrated on a few key species. These are:

Priority 1: Merluccius merluccius

Mullus barbatus

Pagellus erythrinus

Priority 2: Spicara maena

Boops boops

Saurida undosquamis

107. National priorities suggested for future work were:

A. Research in support of management

Cyprus - further population dynamic studies for key species

- pre-recruit surveys and acoustic surveys

- studies on stock identity

Egypt - improving basic statistics

- studies on red mullet

Greece - production modelling for hake and red mullet

- mapping resources of west coast and Aegean

- acoustic surveys (Aegean Sea and off Crete)

- estimates of biological and dynamic parameters for swordfish and other highly migratory species

Israel - better data bases are needed, especially on biological aspects

Turkey - preliminary estimates of biological parameters are needed

EEC - the Community representative emphasized interest by EEC in practical aspects of fishery management in the GFCM area.

He declared that his organization is deeply interested in the fisheries in the Mediterranean Sea, and the logical exploitation of its resources. This interest has been frequently manifested by financing different research aspects realized directly by the member States (e.g. Greece) or with the cooperation of FAO and particularly with the GFCM. He also referred to the fact that the European Parliament has several times expressed the wish for the establishment of a common fishery policy in the Mediterranean, similar to that already established in the Northeast Atlantic. He concluded that everybody is aware of the different kinds of difficulties which face the realization of such an objective, and he believed that when enough scientific information has been collected such a possibility might have a better chance of realization.

B. Management

- Cyprus - a reduction in the number of trawlers in territorial waters is necessary
- experimental management involving closure of some bays for 1-2 years is advisable to explore stock recovery potential
- mesh size to 40 mm
- develop other methods of harvesting Spicara maena
- Egypt - training of fishery managers is a priority
- improved cooperation between State and fishermen
- Greece - experimental closures and openings of different areas/seasons
- increase mesh size
- licence restriction
- Turkey - closed (local) inshore areas for trawling to be modified.

IX. DATE AND PLACE OF THE NEXT CONSULTATION

108. The participants felt that the Consultation had proved extremely useful and that a second consultation should be organized. They further felt that it should take place as early as the end of 1987 in order to estimate the progress made on the adopted programme of work. The period October-December was recommended and it is proposed for the endorsement of the Eighteenth Session of GFCM, Monte-Carlo, 6-10 October 1986.

109. The Consultation left to the Eighteenth Session the care of suggesting a place for the second consultation.

X. ADOPTION OF THE REPORT

110. The report of the first Technical Consultation on Stock Assessment in the Eastern Mediterranean was adopted on 10 April 1986.

I. INTRODUCTION

1. La Consultation technique sur l'évaluation des stocks dans la Méditerranée orientale a été tenue au Siège de la FAO, à Rome, du 7 au 10 Avril 1986.

2. Au nom du Directeur général de la FAO, le Secrétaire du CGPM a souhaité la bienvenue aux participants (dont la liste figure à l'Annexe B).

II. ADOPTION DE L'ORDRE DU JOUR

3. L'ordre du jour reproduit à l'annexe A^{1/} a été adopté.

III. ELECTION DU PRESIDENT

4. Monsieur A. Ben Tuvia a été élu Président de la Consultation.

IV. DESCRIPTION DES PRINCIPALES PÊCHERIES

A. Flottes et engins

5. La Consultation a examiné les caractéristiques ci-après des flottes nationales: taille des bateaux, principaux types d'engins utilisés et différenciation entre pêche artisanale et pêche industrielle. Cette dernière distinction est forcément imprécise; toutefois, à quelques exceptions près, les flottes industrielles de la Méditerranée orientale pêchent au chalut et à la senne coulissante. Dans la plupart des cas, les espèces capturées et les saisons de pêche sont très variables, si bien qu'une classification sur la simple base des caractéristiques des navires n'est pas suffisante pour rendre compte des activités de ces flottes essentiellement polyvalentes.

6. Les caractéristiques des flottes nationales sont brièvement résumées ci-après; on trouvera de plus amples informations sur plusieurs d'entre elles dans les rapports nationaux reproduits aux annexes C à G.

Chypre (Annexe C)

7. On peut distinguer une flotte industrielle de chalutiers (10 unités de 17,5 à 28,5 m de longueur hors tout, équipées de moteurs de 180 à 600 CV, construites entre 1955 et 1964 mais en bon état d'entretien dont certaines pêchent pendant une partie de l'année dans les eaux internationales au large de la côte égyptienne, et une flotte artisanale utilisant principalement des filets calés et des tramails, ainsi que des palangres. Exception faite de l'espadon (principalement pêché toutefois par les artisans-pêcheurs), il

^{1/} La liste des annexes figure à la Table des matières, pages vii et viii

n'existe pas de pêche industrielle des espèces pélagiques. La flottille artisanale compte 477 unités de 2,5 à 12,8 m de long, et un pourcentage élevé de bateaux et de pêcheurs opèrent seulement à temps partiel ou occasionnellement (leurs captures sont toutefois vendues sur le marché).

Egypte (Annexe D)

8. La flottille compte approximativement 1 420 bateaux équipés de moteurs de 10 à 230 CV (dans la majorité des cas de moins de 70 CV), appartenant à 15 coopératives de pêcheurs. La production de poisson est de 20 000 tonnes et provient de trois secteurs de la côte méditerranéenne; le secteur situé entre Alexandrie et Port Saïd est celui où opèrent le plus de bateaux et où se concentre l'effort de pêche; divers engins sont utilisés, notamment les chaluts démersaux, les seines de plage, les filets maillants dérivants, les tramails, les palangres, les lignes à main et les sennes soulissantes.

Israël (Annexe E)

9. Mise à part la flottille industrielle à grand rayon d'action opérant hors de la Méditerranée, les bateaux pêchant le long de la côte israélienne ont au maximum 27 m de long (et sont équipés de moteurs de 300 CV). Toutefois, il n'existe pas de distinction pratique entre les navires artisanaux et les navires industriels. A des fins statistiques, on peut néanmoins distinguer les navires côtiers (de moins de 11 m de long, équipés de moteurs à bord ou hors bord), les petits senneurs à senne coulissante de 11 à 14 m de long dont la puissance va jusqu'à 80 CV et les chalutiers de 14 à 25 m de long dont la puissance va jusqu'à 300 CV. Les engins utilisés sont très divers: chaluts de fond, sennes coulissantes, filets maillants et palangres. Le chalutage ne peut pas être considéré comme entièrement démersal, puisque l'on a commencé à utiliser il y a quelques années des chaluts à grande ouverture verticale. Le qualificatif qui décrit le mieux cette pêcherie est celui de "polyvalente"; en effet, quoiqu'il soit possible de classer les bateaux par principaux types d'engins utilisés, il existe un haut degré d'adaptabilité saisonnière; par exemple, le sennage peut être pratiqué pendant une période pouvant aller jusqu'à quatre mois, le navire passant ensuite à la pêche à la palangre ou au tramail pendant le reste de l'année. Depuis quelques années, on observe une forte tendance à la diversification des engins de chalutage; par exemple, l'emploi de treuils enrouleurs permet de changer rapidement de type de chalut. Entre autres améliorations techniques, on s'est également efforcé de réduire la consommation de carburant pendant les opérations de pêche.

10. Les petits navires côtiers utilisent aussi de plus en plus des échosondeurs modernes leur permettant de repérer des fonds de pêche plus productifs. Le nombre et l'activité des navires côtiers ont considérablement augmenté depuis quelques années.

11. Les navires pratiquant la pêche pélagique utilisent des filets de 2 000 à 3 000 mètres de long manœuvrés par des power blocks; selon la saison, ils utilisent des filets à petite maille pour capturer les sardines ou des filets à maille plus grande pour capturer les petits thonidés. Les chaluts pélagiques Engel ont été introduits pour le chalutage à proximité du fond, ainsi que des panneaux de chalut modernes polyvalents permettant d'économiser le carburant et plus faciles à manœuvrer.

Grèce (Annexe F)

12. La flottille industrielle grecque consiste essentiellement en très vieux chalutiers: 20 pour cent d'entre eux ont plus de 40 ans et quelques-uns sont en cours de remplacement.

13. Depuis 1976, année où la flottille a cessé d'avoir accès aux eaux situées au large de la côte nord-africaine, les bateaux qui pêchaient précédemment dans les eaux lointaines sont revenues opérer dans les eaux nationales grecques; la production de poisson par bateau a diminué et le revenu de la pêche est surtout maintenu grâce au relèvement des prix unitaires des poissons de fond.

14. Au total, quelque 9 800 bateaux de plus de 20 CV se livrent à la pêche cotière, ce qui représente un accroissement de 11 pour cent depuis 1974.

15. A l'effectif ci-dessus s'ajoutent approximativement 12 000-14 000 bateaux de moins de 20 CV et les quelque 20 000 unités de la flottille des pêcheurs amateurs, plus un nombre sans cesse décroissant de bateaux non motorisés (784 en 1981), qui opèrent tous le long des côtes. Les principaux engins utilisés sont les filets maillants et les tramails, les palangres, les chaluts, les pièges et les sennes.

16. Une flottille de senneurs de 50 à 400 CV et de 11 à 20 mètres de long opèrent également de nuit ou de jour dans les eaux grecques.

17. Le tonnage total de la flottille (senneurs et chalutiers), s'accroît constamment ce qui tient en partie à la libération des prix du poisson en 1979.

18. Le chalutage pélagique est interdit dans les eaux grecques.

Turquie (Annexe G)^{1/}

19. La flottille turque pêchant dans la mer Egée (1 342 bateaux) et dans la mer Méditerranée (887 bateaux) consiste principalement en petits bateaux, pour la plupart de moins de 20 CV, qui opèrent le long des côtes. Les principaux engins utilisés sont les petits chaluts, les palangres, les filets maillants et les tramails. Quelques senneurs à senne coulissante pêchent dans les

^{1/} Le document suivant a également été présenté à la Consultation: The state of Turkish Mediterranean fisheries, par F. Bingel, METU, Institute of Marine Sciences, İçel

golfs de Mersin et d'Iskenderun. Une licence doit être obtenue des autorités locales pour pratiquer le chalutage pélagique dans les eaux turques. Pendant l'hiver, jusqu'à 20 senneurs à senne coulissante viennent de la mer Noire pour pêcher les poissons bleus migrateurs - bonite à dos rayé, chinchard et anchois - principalement dans le golfe d'Enez.

20. Les bateaux effectuent parfois des migrations saisonnières entre la mer Noire et la Méditerranée, surtout pour pêcher l'espadon. Cela complique encore le dénombrement de la flottille, déjà rendu difficile par la longueur des côtes et l'éparpillement des lieux de débarquement.

B. Approche sous-régionale de la classification statistique

21. Les échanges de vues à la Consultation ont montré la nécessité de normaliser la classification des bateaux de pêche, de préférence dans tout le bassin oriental de la Méditerranée. La puissance en chevaux-vapeur et/ou la taille des bateaux ne sont pas des critères suffisants, ni même probablement les critères les plus importants, quoique les informations correspondantes puissent être indispensables pour certaines raisons (par exemple fiscales) dans un registre national à jour des bateaux de pêche. Peut-être faudrait-il adopter comme premier critère de classification la principale méthode de pêche utilisée. Les principales catégories ci-après de bateaux de pêche sont suggérées sur cette base:

- navires pêchant au filet maillant,
- palangriers,
- senneurs à senne coulissante,
- chalutiers.

On pourrait éventuellement établir des subdivisions en fonction de la taille/puissance en CV et, si l'on dispose de données à ce sujet, des engins secondaires et des principales espèces recherchées par chaque bateau/combinaison d'engins.

22. Au terme de cet examen, il a été proposé d'utiliser, pour la classification statistique des bateaux de pêche de la région, un système normalisé basé sur la principale méthode de pêche employée. La Consultation a chargé M. Grofit de préparer un formulaire approprié pour la communication des informations, qui sera distribué par le Secrétariat aux pays de la Méditerranée orientale aux fins d'observation et d'approbation.

C. Réglementations en matière de pêche et dispositions d'application

(a) Delivrance des licences aux bateaux de pêche

23. Les réglementations en vigueur à Chypre limitent le nombre des chalutiers de la flottille, mais non celui des bateaux de plus petite taille.

24. En Egypte, un système de licences est appliqué par le Ministère des transports dans les eaux nationales, mais le nombre de licences n'est pas limité; des statistiques de la flottille sont toutefois établies.

25. En Grèce, les entrées dans la pêche ne sont pas limitées, puisque le nombre de bateaux de pêche ne l'est pas. A noter toutefois que la délivrance de nouvelles licences de chalutage a été suspendue en 1985. Depuis 1977, il a fallu trouver une utilisation à de nombreux bateaux de pêche industrielle qui opéraient antérieurement dans des eaux lointaines. Un exploitant doit être un pêcheur pour être autorisé à construire ou acheter un nouveau bateau. Les artisans-pêcheurs doivent être titulaires de licences individuelles et, dans le cas de la flottille industrielle, les licences sont délivrées aux bateaux.

26. En Turquie, il n'y a pas de système de licences pour limiter l'effort de pêche, mais les investissements dans les grands bateaux sont contrôlés.

27. En Israël, les licences sont délivrées aux bateaux par le Ministère des transports. Les pêcheurs doivent tous être titulaires de licences délivrées par le Département des pêches. Les capitaines des bateaux doivent également être en possession de licences spéciales qui dépendent de la taille du bateau. Les réglementations en vigueur visent à maintenir la dimension présente de la flottille dont les débarquements sont, semble-t-il, relativement stables; dans l'avenir, les licences seront délivrées pour une méthode, une saison et un lieu de pêche déterminés. Il a également été proposé de limiter le nombre total de chalutiers de la flottille et sa puissance en chevaux-vapeurs.

(b) Limites de taille et réglementation du maillage

28. A Chypre, une maille étirée de 34 mm est jugée nécessaire pour capturer Spicara maena, petit poisson effilé qui, semble-t-il, passe à travers une maille de 40 mm. On craint sérieusement toutefois que les captures accessoires de Mullus et de Pagellus immatures dans cette même pêche ne n'affectent le potentiel de reproduction de ces espèces; en outre, un certain nombre d'espèces précédemment abondantes sont maintenant beaucoup moins répandues ou de taille plus petite.

29. En Egypte, aucune réglementation du maillage n'est actuellement appliquée et de très petits maillages sont utilisés dans certaines pêcheries.

30. En Grèce, on s'efforce actuellement de faire utiliser un maillage plus grand pour les culs-de-chalut et il est interdit de commercialiser des poissons mesurant moins de 8 à 10 cm. Cela soulève un grave problème dans la pêche de merlu, car il faut rejeter à la mer les poissons de petite taille à certaines époques de l'année (70 pour cent des captures de merlus consistent en sujets de un an ou moins).

31. En Israël, pays où il n'existe pas de fabriques d'engins de pêche, le maillage est principalement contrôlé par le moyen de restrictions des dimensions des engins importés et l'observation des règles est facile à surveiller. Le rouget de roche était l'espèce à laquelle on se référait habituellement pour décider du maillage des culs-de-chalut, lequel doit permettre de retenir 50 pour cent des sujets de taille inférieure à 110 mm (qui aujourd'hui ne représente qu'un faible pourcentage de captures). La mise en vigueur d'un unique maillage normalisé dans une pêcherie multispécifique soulève néanmoins des difficultés évidentes. En Israël toutefois, étant donné le prix plus élevé obtenu pour les poissons de grande taille et les tailles minimales exigées par la loi au stade de la commercialisation, le contrôle du maillage n'est pas le problème principal: le marché règle en fait le maillage utilisé et il n'est pas nécessaire de contrôler rigoureusement l'observation des tailles minimales. Il n'en est pas de même dans les autres pays, notamment en Egypte, à Chypre et en Grèce, où les poissons de petite taille représentent une forte proportion des captures.

TABLEAU 1

Maillages minimaux en vigueur dans la Méditerranée orientale

<u>Pays</u>	<u>Cul-de-chalut (maille étirée)</u>	<u>Senne de plage</u>	<u>Senne coulissante</u>
Chypre	34 mm		
Egypte	Aucune réglementation*		
Grèce	28 mm		
Israël	48 mm		20 mm
Turquie	40 mm	36 mm	

* Une maille étirée de 18 mm est normalement utilisée

(c) Autres réglementations en matière de pêche

32. Dans la Méditerranée orientale, la détermination des conditions d'accès des flottilles industrielles et artisanales aux fonds de pêche proches du littoral et aux nurseries situées dans des habitats critiques tels que les estuaires, les lagunes et les eaux peu profondes revêt une très grande importance. Dans plusieurs pays, il y a déjà ou il risque d'y avoir des conflits entre les divers groupes de pêcheurs et on s'est efforcé de remédier à cette situation en établissant des saisons de pêche et des règles d'accès différenciées. Les administrations adoptent donc diverses méthodes en vue de résoudre à la fois le problème de la conservation et celui de l'accès, mais non généralement en vue de contrôler l'effort de pêche ou les quantités débarquées (contingents). La Consultation a estimé qu'il faudrait échanger des informations sur l'efficacité des diverses mesures en vigueur et elle a notamment recommandé de donner la priorité à l'identification des zones qui revêtent de l'importance pour le recrutement des principales espèces (nurseries).

33. A Chypre, la pêche industrielle au chalut ne doit pas être pratiquée par plus de 55 mètres de fond. Un service de protection des pêcheries disposant de 3 vedettes est chargé de la surveillance en mer. Les patrouilles ont lieu deux fois par semaine. La fermeture saisonnière de la pêche industrielle au chalut, qui était précédemment de quatre mois, a été prolongée jusqu'à octobre compris en 1981 pour protéger de la surexploitation les juvéniles de l'année entrant dans la pêcherie. Cette mesure explique peut-être l'accroissement des captures au cours des deux dernières années. La pêche artisanale ne fait quant à elle l'objet d'aucune réglementation.

34. En Egypte, il n'y a pas de saisons de fermeture de la pêche. Toutefois, il n'est pas permis de pêcher à moins de 2 km de l'embouchure des cours d'eau. Il n'est pas non plus permis de pêcher à proximité de la frontière libyenne.

35. En Israël, il est interdit de pêcher dans certaines zones, par exemple à proximité des estuaires, et de chaluter à moins de deux milles de la côte (cette zone étant réservée aux engins fixes); toutefois, cette dernière réglementation est rarement observée car les fonds à crevettes se trouvent près du rivage sur un plateau continental étroit. Il a été proposé de réserver certaines zones à la pêche côtière avec des engins fixes. Il n'existe pas actuellement de fermeture saisonnière de la pêche au chalut.

36. En Grèce, l'interdiction saisonnière du chalutage vise à protéger les juvéniles des poissons de fond pendant les mois d'été. Le chalutage est en outre interdit pendant une période plus longue dans certaines baies et golfes. Il est complètement interdit à moins de un mille du rivage, et à moins de deux milles de l'embouchure des cours d'eau et des lagunes.

37. En Turquie, il n'y a pas de saison de fermeture de la pêche au chalut; toutefois, le sennage est interdit à proximité du rivage pendant les mois d'été. Le chalutage est interdit à moins de trois milles de la côte.

38. Le tableau 2 indique les saisons de fermeture de la pêche dans la Méditerranée orientale.

TABLEAU 2

Fermeture saisonnière de la pêche, par pays

<u>Pays</u>	<u>Engins</u>	<u>Période de fermeture de la pêche</u>
Chypre	Chaluts (flottille industrielle)	Juin-octobre (compris)
Egypte	-	Pas de saison de fermeture
Grèce	Chaluts (flottille industrielle)	Juin-septembre (compris)
Israël	-	Pas de saison de fermeture
Turquie	Sennes dans les zones côtières	1er avril - 15 mai

D. Données disponibles sur les captures, par type de pêche et par secteur

(a) Collecte de données statistiques et mécanismes mis en place par les gouvernements à cet effet

39. A Chypre, les données sur les quantités débarquées (livres de bord) par la flottille industrielle sont recueillies par une équipe de deux-trois fonctionnaires du District Office et sont traitées sur ordinateur. Les sondages en vue de constituer une base de données sur la pêche artisanale sont moins réguliers. Les données sur l'effort de pêche et sur les captures par unité d'effort sont traitées par la Section des statistiques.

40. Le nombre d'espèces représentées dans les captures démersales a diminué d'environ 20 pour cent au cours des dix dernières années et la taille moyenne de certaines espèces, par exemple les mullets, a également diminué. Dans le cas de Chypre, il a été suggéré que l'on pourrait comparer les quantités débarquées par espèce avec les quantités capturées par les navires de recherche, en vue d'obtenir un indice d'exploitation par espèce.

41. En Egypte, le poisson est débarqué dans neuf ports principaux du littoral méditerranéen et les données relatives à 1 421 bateaux de pêche sont collectées par une équipe d'inspecteurs des pêches. Cinquante pour cent des bateaux ont de moins de 50 CV et opèrent à 1-2 milles du rivage, avec toute une variété d'engins, notamment des lignes à main, des sennes de plage, des filets dérivants, des sennes coulissantes, des tramails et des palangres. Le reste de la flottille consiste en senneurs à senne coulissante et chalutiers pêchant par moins de 150 mètres de fond. La production annuelle totale des pêches maritimes (à l'exclusion des lagunes) est de 20 000 tonnes. Un bulletin statistique est publié chaque année en arabe. Le garde-côte vérifie le temps passé en mer par les grands bateaux. L'échantillonnage biologique a commencé récemment; il concerne plus particulièrement les fréquences de taille et le contenu de l'estomac des poissons. On ne recueille pas de données sur l'effort de pêche ni sur les taux de captures, quoique certaines estimations indiquent que les chalutiers capturent 16 kg à l'heure et les senneurs à senne coulissante 486 kg en 24 heures; pour les autres engins, la capture est évaluée à 75 kg en 24 heures.

42. Le navire de recherche FRIDTJOF NANSEN a récemment prospecté les eaux méditerranéennes de l'Egypte en vue de déterminer l'abondance des diverses espèces.

43. Pour la Grèce, il existe une longue série chronologique de données sur les quantités débarquées, collectées par les autorités douanières locales, exception faite de la période 1939-64 pendant laquelle aucune donnée n'a été recueillie. Un rapport annuel sur les quantités débarquées est publié deux ans après la collecte des données. Les captures par espèce sont présentées pour chacune des seize zones statistiques nationales. On ne recueille pas de

données sur l'effort de pêche ni sur les captures par unité d'effort, mais les chiffres relatifs aux captures mensuelles sont quelquefois disponibles. Le Centre national de recherche marine recueille actuellement des données sur les fréquences de longueur de plusieurs espèces capturées.

44. En Israël, un système informatisé de surveillance continue permet de calculer les captures des chalutiers par heure et par jour sur la base des données communiquées à la radio sept fois par jour pour chacune des onze divisions statistiques de la grille établie pour les pêches. Il est donc possible de connaître en détail les captures et l'effort de pêche de la flottille de chalutiers. Le chalutier moyen pêche 200 jours par an et capture 20 kg de poisson par heure de chalutage.

45. Les données concernant les débarquements de la flottille de senneurs à senne coulissante peuvent être recueillies dans les conserveries en se référant aux contrats conclus avec les pêcheurs, puisque 90 pour cent des quantités débarquées sont destinées à des sociétés. Pour la flottille côtière en expansion, les données statistiques sont plus difficiles à collecter; elles sont obtenues en procédant à un échantillonnage indicatif de plusieurs bateaux, et la marge d'erreur est assez importante (20-30 pour cent).

46. Il n'existe pas de programme d'échantillonnage biologique pour ce qui concerne la longueur ou l'état au moment de la reproduction; toutefois, un échantillonnage systématique a été entrepris à toutes les saisons/profondeurs pour Merluccius en vue de déterminer les fréquences de taille et le contenu stomacal. Le traitement des données n'est pas encore achevé.

47. Le manque de personnel pour l'échantillonnage soulève des difficultés; il y a trois inspecteurs des pêches qui sont chargés de veiller à l'application des réglementations et de délivrer les licences, ainsi que de rassembler des données statistiques. Bien qu'il n'y ait pas de statisticiens spécialisés, un bulletin annuel est publié.

48. A Chypre, les données statistiques sur la pêche industrielle et sur la pêche artisanale sont recueillies séparément par des fonctionnaires de district qui collectent les livres de bord signés chaque jour par les capitaines des chalutiers. Le traitement sur ordinateur des statistiques du chalutage commence cette année.

49. En Egypte, en 1985, la puissance totale de la flottille de chalutiers s'établissait à 111 732 CV et la capture totale à 11 400 tonnes; la puissance totale de la flottille de senneurs était de 18 720 CV et elle capturait 7 500 tonnes de poisson. Pour d'autres bateaux opérant le long des côtes, une puissance totale de 10 790 CV correspondait à une capture de 2 068 tonnes.

50. En Turquie, depuis deux ans, le Ministère de l'agriculture et l'Institut national de statistique (DIE) recueillent ensemble les données dans les bureaux locaux de tous les ports importants. Ces données sont envoyées chaque mois à Ankara. Des rapports annuels sont publiés.

51. Le DIE effectue également des sondages sur les marchés du poisson avec des fonctionnaires du Ministère de l'agriculture, en vue de déterminer la composition par espèce du poisson localement débarqué.

52. Certains doutes ont été exprimés quant à l'origine locale de ces débarquements, car une partie de la flottille évolue entre la mer Egée et la mer Noire; mais, comme les bateaux ne possèdent pas d'installations de congélation à bord, il est peu probable que l'origine locale des quantités débarquées soit vraiment discutable. On ne recueille pas de données sur les captures ni sur le taux de capture et, exception faite de plusieurs groupes universitaires, aucun programme d'échantillonnage biologique n'a encore été entrepris. Un programme quinquennal de recherches et d'échantillonnage biologiques commencera sous peu.

(b) Besoins futurs de données pour la recherche halieutique

53. Exception faite de Chypre, où un navire de recherche se trouve sur des emplacements de référence presque chaque semaine de l'année - si les conditions météorologiques le permettent - il n'existe pas pour le moment dans la Méditerranée orientale de dispositifs permettant de recueillir régulièrement des données sur les taux - types de capture par engin de pêche-type. On s'est demandé s'il serait souhaitable de mettre en place une sorte de système national normalisé pour surveiller l'abondance des ressources, en particulier pour ce qui concerne les espèces démersales et, plus spécialement, le recrutement. Pour les études prévisionnelles des pêcheries, on pourrait notamment prévoir des sondages stratifiés par chalutage en vue d'estimer directement l'abondance, ou des enquêtes transversales types dans les stations de pêche des zones d'importance commerciale ou des zones où les nouvelles classes annuelles (recrues) sont abondantes.

54. On a suggéré que les administrations des pêches devraient étudier la possibilité de mettre sur pied un quelconque système de surveillance de l'abondance des poissons, prévoyant l'application, par des navires commerciaux ou des navires de recherche, d'un plan de pêche normalisé permettant de suivre sur de longues périodes les modifications de l'abondance des principales espèces, en particulier les espèces démersales.

55. A l'issue des échanges de vues sur ce point, la Consultation a recommandé que chaque pays membre s'engage à publier un bulletin statistique annuel en anglais ou en français et le communique à tous les instituts de recherche de la Méditerranée orientale; elle a également recommandé que les unités standards ci-après soient utilisées pour exprimer l'effort de pêche à des fins statistiques:

Filets maillants: capture par 100 m de filet installé, par calée
Palangres: capture par 100 hameçons, par calée
Sennes coulissantes: capture par jour ou par heure de recherche sur les fonds
Chaluts: capture par heure, par catégorie de puissance en CV
(dimension et type de chalut à préciser)

V. ESTIMATIONS EXISTANTES DES PARAMETRES BIOLOGIQUES ET DYNAMIQUES DES PRINCIPAUX STOCKS

A. Croissance

56. Etant donné que certaines ressources sont intensément pêchées, il peut arriver que l'on capture relativement peu de sujets âgés de certaines espèces. En tels cas, l'ajustement de la courbe de croissance, en particulier lorsque la méthode utilisée est l'analyse modale des fréquences de taille, peut conduire à des valeurs de K inférieures aux valeurs prévues, à des valeurs de L_{∞} (taille maximale) plus élevées et à des valeurs importantes (négatives) de t_0 . Une méthode utilisée consiste à compléter les séries de données avec les rares informations disponibles sur les poissons plus âgés, en particulier ceux dont l'âge a été déterminé par la lecture des otolithes. Une autre méthode consiste à inclure les tailles moyennes pour $t < 1$ an.

57. On peut noter quelques progrès, spécialement à Chypre et en Grèce, dans les recherches sur les taux de croissance et de mortalité d'espèces de poisson particulièrement importantes dans le commerce. Quelques-unes de ces recherches sont décrites dans les communications jointes en annexe.

58. Des estimations des paramètres de croissance ont déjà été faites dans certains pays. Ainsi, Chypre dispose (von Bertalanffy) d'estimations de la corrélation entre la longueur et le poids pour sept espèces, et cinq autres espèces sont à l'étude. La Grèce a déjà soumis des estimations pour le merlu, le rouget de roche, le pageot rouge, les grondins et les baudroies à la quatrième Consultation technique sur l'évaluation des stocks dans l'Adriatique (octobre 1985), ainsi qu'à des revues scientifiques (voir également les annexes H à L). On étudie actuellement la dorade royale en Egypte et les rougets de roche en Israël. Des recherches sur les penaeïdes (P. semisulcatus et P. japonicus) ont également été entreprises en Israël où, de même qu'en Turquie et en Egypte, la plupart des études de ce type sont entreprises par les universités; il serait utile que ces chercheurs puissent participer à des consultations futures.

59. Des méthodes variables ont été utilisées pour étudier l'âge et la croissance mais, en général, la lecture des otolithes a donné de bons résultats et, utilisée en combinaison avec l'analyse des fréquences de taille, elle a permis de construire des clés âge/longueur.

60. La lecture des écailles a donné de moins bons résultats et on s'est heurté à quelques difficultés considérables avec les méthodes entièrement fondées sur l'analyse des fréquences de taille. Celles-ci ont été examinées à la Consultation et un certain nombre de remarques générales ont pu être formulées.

61. Etant donné la forte exploitation des sujets de petite taille au début de leur vie ainsi que des espèces à vie courte, il est évidemment important de déterminer convenablement le taux de croissance au cours des deux premières années. Il serait sans doute nécessaire de faire des observations trimestrielles de la taille moyenne à un certain âge, en utilisant, chaque fois que possible, des engins de prélèvement à petite maille pour être à même de mieux repérer la taille au moment de la formation du premier anneau. Notant que la lecture des stries quotidiennes a donné de bons résultats, la Consultation a demandé à M. P. Walline d'étudier s'il serait possible d'utiliser des techniques de repérage de la croissance quotidienne pour identifier le premier anneau sur les otolithes de plusieurs espèces importantes.

62. En conclusion, la combinaison d'un échantillonnage spécial des juvéniles pour la détermination des fréquences de taille et de l'examen des otolithes des individus plus âgés donnerait peut-être de meilleures indications de la valeur des paramètres de von Bertalanffy.

63. Plusieurs participants se sont plaints du logiciel actuellement disponible pour analyser les tendances des populations; les tentatives de programmation de méthodes publiées se sont soldées par des pertes de temps considérables et des doubles emplois. La FAO a été priée d'aider à la préparation d'un logiciel plus satisfaisant.

64. L'idée d'organiser des échanges d'otolithes en vue de comparer les méthodes d'estimation de l'âge et de la croissance a été approuvée, et la priorité a été donnée aux espèces Mullus barbatus et Merluccius merluccius. Les participants initiaux au programme seraient:

<u>Pays</u>	<u>Nom</u>
Chypre	R. Livadas
Egypte	M. Hegazy et N. Bollis (Office central pour la mise en valeur des ressources de poisson)
Grèce	C. Papaconstantinou
Turquie	S. Dinçer, Sünger Araştırma, Merkezi, Bodrum
Israël	S. Pisanty, D. Golany

65. Les participants échangeront des otolithes numérotés, avec les indications correspondantes sur la longueur, le sexe, le lieu et la date de capture des poissons, pour toute une série de tailles; il sera procédé à la lecture de

l'âge pour chaque poisson numéroté et les interprétations seront envoyées au Secrétariat aux fins de comparaison. (Ne pas indiquer l'âge sur le matériel fourni, étant donné que le but du programme est une comparaison indépendante des méthodes de lecture.) Les participants fourniront au CGPM une liste de personnes qui s'intéressent à la biologie des pêches et à la dynamique des populations, aux fins de distribution à d'autres chercheurs.

B. Estimations de la mortalité

66. La Consultation a examiné les problèmes liés à la détermination des taux de mortalité des espèces susceptibles d'accomplir des migrations (verticales et horizontales) pendant leur cycle biologique; le merlu, par exemple, se déplace probablement entre les mers Adriatique et Ionienne. On a souligné la nécessité d'échantillonner toute l'aire de répartition du stock, ce qui pourrait soulever des difficultés pratiques, car notre connaissance des stocks unitaires en cause est encore élémentaire.

67. Les estimations qui ont déjà été faites permettent de penser que les taux de mortalité totale pourraient être proches de $Z = 1$ dans certaines zones, par exemple pour le pageot rouge dans les eaux grecques, ce qui suggère des taux d'exploitation élevés; dans les eaux chypriotes également, il semble que les taux de mortalité augmentent de façon continue avec t_i . Il faudra recueillir sur une base ininterrompue des informations complémentaires sur la composition par âge des captures des navires commerciaux et des navires de recherche pour qu'il devienne possible d'utiliser des méthodes plus perfectionnées telles que l'analyse de cohorte, comme on s'efforce déjà de le faire à Chypre.

68. Le Secrétaire technique a soulevé le problème des valeurs relativement peu élevées de M actuellement obtenues (de l'ordre de $M = 0,1-0,2$) avec des méthodes fondées sur les corrélations statistiques entre les paramètres de croissance et les taux de mortalité naturelle. Si de faibles valeurs de K , plus typiques des régions boréales, sont obtenues, peut-être en raison de biais dans les estimations des paramètres examinées plus haut, on obtiendra aussi de faibles valeurs de M , ce qui bien-sûr affectera les calculs consécutifs des rendements.

C. Reproduction et recrutement

(a) Reproduction

69. A Chypre, on a suivi le développement des gonades en utilisant l'échelle Maier à 8 graduations^{1/}, l'échantillonnage étant effectué à intervalles de 15 jours. Dans les eaux chypriotes, la plupart des espèces se reproduisent d'avril à juin, exception faite du merlu qui semble frayer tout au long de l'année. Des estimations de la fécondité ont été faites pour certaines espèces.

^{1/} Holden, M.J. et D.F.S. Raitt (eds), Manuel de science halieutique. Partie 2.
1974 Méthodes de recherche sur les ressources et leur application.
FAO Doc.Tech.Pêches, (15)Rev.1:223 p. Publié aussi en anglais
et en espagnol

70. En Egypte, le mullet cabot se reproduit en janvier-avril, ainsi qu'en juillet-novembre. En Grèce, on a étudié l'âge à la maturité et la fécondité du merlu; ce poisson fraye tout au long de l'année, plus spécialement en février-mars (mer Egée) et en novembre (mer Ionienne). L'âge à la première maturité est de 3-4 ans; la maturité complète n'est atteinte que plus tard. Le rouget de roche et le pageot rouge frayent de la mi-avril à juin; ils se reproduisent pour la première fois à la fin de la deuxième année de leur vie, leur longueur étant alors de 13-14 cm.

71. En raison de la fécondité partielle, il est difficile de définir la taille à laquelle 50 pour cent de la population est mûre.

72. En Israël, Sardinella atteint sa première maturité sexuelle pendant la deuxième année de sa vie, quelle que soit sa taille; la période de fécondité est ensuite très longue.

73. En Turquie, la date de la reproduction varie en fonction des conditions écologiques dans une zone côtière très longue. Il est prévu de recueillir des données sur la taille au moment de la reproduction pour environ 10 espèces économiquement importantes à partir de 1986, année où le Ministère de l'agriculture doit mettre en route un programme de cinq ans à l'appui des activités d'évaluation des stocks.

(b) Recrutement

74. A Chypre, pour la plupart des espèces, l'âge de début de capture commence à 6-7 mois (elles ont alors 7-9 cm de long et sont pêchées avec des filets à maille de 32 mm). Il n'existe pas de nurseries spécialement réservées aux juvéniles.

75. Les nurseries des rougets de roche et des pageots rouges se trouvent à proximité des embouchures des cours d'eau; la migration vers les eaux plus profondes a lieu en novembre.

76. En Israël, on connaît également l'emplacement des nurseries des rougets de roche. Le recrutement dans la pêcherie commence à 9 cm; la taille à la maturité est de 11-12 cm.

77. Chypre a entrepris une enquête sur le recrutement en novembre 1985. En raison du petit maillage utilisé, les poissons du groupe 0 sont capturés dans le sac des engins commerciaux. Les observations sur la taille moyenne à l'âge peuvent toutefois être biaisées si les petits poissons ne sont que partiellement retenus dans le filet. Les avantages de l'utilisation d'engins spéciaux pour prélever des échantillons quantitatifs ont été discutés: un chalut à perche à petite maille, avec un sac à maille de 10 mm, a été utilisé avec succès pour l'échantillonnage des juvéniles de rougets de roche et de crevettes en Israël. L'emploi judicieux de sennes de plage permet aussi de faire des estimations quantitatives de l'abondance des recrues (par exemple pour les sparidés et les serranidés).

D. Sélectivité

Chypre

78. Des essais de sélectivité du maillage ont été entrepris en Chypre en 1977 pour donner suite à la résolution du CGPM concernant l'utilisation d'une maille étirée de 40 mm au minimum. Des facteurs de sélection sont disponibles pour les mailles de 34 et 40 mm. La maille plus grande, de 40 mm, est nécessaire pour épargner les mullidés qui sont devenus rares et dont on ne trouve maintenant que deux classes d'âge dans les débarquements. Les pertes à court terme résultant de l'accroissement du maillage ont été calculées. L'utilisation de la maille de 40 mm soulève une difficulté avec Spicara maena; ce poisson gracieux à vie courte se reproduit à l'âge de 1 an et est un hermaphrodite protogyne.

Egypte

79. On ne possède actuellement aucune information sur la sélectivité du maillage.

Grèce

80. La maille de 28 mm actuellement en vigueur n'est pas très sélective. Une étude financée par la CEE est en cours.

Israël

81. En Israël, l'expérience a montré que la maille de 48 mm actuellement en vigueur est valable du point de vue économique. Le choix du maillage ne suffit pas toutefois à assurer la sélectivité. La maille double (du type utilisé dans les pêcheries de crevettes) et la tension du filet mis à l'eau assurent une sélection efficace dans le cul-de-chalut.

82. Le Secrétaire technique a fait ressortir que, si l'utilisation d'une maille plus grande entraîne des pertes à court terme avant que ne soient recueillies les avantages à long terme de l'accroissement de la taille du poisson, la durée de ces pertes est cependant brève dans la Méditerranée. A l'heure actuelle, l'âge de début de capture est bas et, pour la plupart des espèces, il faudrait moins d'un an pour obtenir de meilleurs rendements car la croissance des très jeunes poissons est extrêmement rapide. A titre expérimental, on pourrait interdire la pêche avec des engins à petite maille dans une zone restreinte (par exemple autour d'une île) pendant deux ou trois ans, pour évaluer les résultats.

E. Principales communautés de poissons démersaux

83. En Israël, d'importantes modifications des communautés de poissons ont été observées pendant les quarante dernières années. Certaines d'entre elles ont des causes économiques - par exemple, les captures de merlu ont diminué parce

que le coût du chalutage en eau profonde est trop élevé pour un poisson de relativement faible valeur marchande. L'autre changement important a été l'introduction continue par le canal de Suez d'espèces de l'Indo-Pacifique, à raison d'environ une espèce de poisson tous les deux ans; certaines d'entre elles sont devenues commercialement importantes. Ce phénomène a contribué à la création d'une faune levantine spéciale dans la zone allant du sud de la mer Egée à la Libye, où jusqu'à 30 pour cent des captures actuelles de poissons démersaux tels que Leiognathus et Saurida undosquamis et plusieurs espèces de crevettes commercialement importantes sont d'origine exotique.

84. Les données limitées sur les captures par espèce qui ont été présentées semblent indiquer quelques modifications remarquables de l'abondance des espèces, particulièrement si l'on considère les quantités débarquées à Chypre; toutefois, on ne sait pas vraiment dans quelle mesure ces changements résultent de fluctuations naturelles des espèces ou des activités de pêche. Pour Chypre néanmoins, certains signes indiquent que la diversité des espèces capturées a diminué au cours des dix dernières années.

85. Une analyse des données rétrospectives sur les quantités débarquées en Grèce (1928-39) suggère qu'il y a eu au cours de cette période des fluctuations marquées dans la composition de ces débarquements qui ne s'expliquent pas toutes par les préférences du marché ou l'évolution des techniques de pêche. En l'absence de séries chronologiques de données hydrographiques, qui ne semblent pas exister pour cette zone, il semble néanmoins qu'il existe une corrélation entre les quantités débarquées et la température de l'air; il conviendrait de l'étudier de manière plus approfondie en explorant les sources possibles de données et en examinant les rapports réciproques entre le climat, l'hydrographie et la production biologique dans l'ensemble de la Méditerranée.

86. L'autre conséquence importante de la pêche examinée dans les documents publiés dans le passé concerne les effets supposés du barrage d'Assouan qui aurait réduit le flux d'éléments nutritifs provenant du delta du Nil, qui alimentaient autrefois une florissante pêcherie de sardines. Il existe maintenant certains signes que ce stock existe encore mais ne vit plus sur les mêmes emplacements et aux mêmes profondeurs qu'autrefois, et qu'il n'est plus aussi facilement accessible aux pêcheurs, à l'exception de ceux qui utilisent des techniques d'attraction lumineuse.

87. Il semble que les espèces à vie courte prédominent maintenant dans certaines pêcheries intensément exploitées. A Chypre, par exemple, Spicara maena est devenue plus abondante et le fait que les captures de céphalopodes dans les eaux grecques ont été plus importantes au cours de la dernière décennie que pendant les années trente est un indicateur écologique possible d'une forte intensité d'exploitation.

88. Quelques études trophiques ont été effectuées sur plusieurs espèces dans les eaux grecques; elles ont fait apparaître que la concurrence pour la nourriture entre diverses espèces importantes est limitée. Aucune étude détaillé de la chaîne alimentaire ne semble avoir été faite dans la Méditerranée orientale.

89. Dans la plupart des pays, l'industrie de la pêche connaît en détail les caractéristiques des zones exploitées et les divers types de fonds sur chacun desquels vit une communauté de poissons assez distincte. Il ne devrait pas être impossible d'établir des cartes de fonds de pêche, ainsi qu'il a déjà été fait pour la Méditerranée occidentale.

F. Rejets à la mer

90. Dans la Méditerranée orientale, les rejets sont relativement peu fréquents (sauf dans le cas des espèces impossibles à commercialiser) parmi les captures de poissons démersaux, exception faite de certains rejets saisonniers, par exemple les juvéniles de merlu et, en novembre, les petits rougets de roche (Grèce); en Egypte, certains rougets de roche et Boops sont également rejetés à la mer. Depuis l'introduction de la maille de 48 mm, peu de poissons démersaux trop petits sont capturés en Israël; les rejets sont toutefois estimés à 20 pour cent (y compris les espèces non commercialisables) dans le cas de la pêche au chalut. L'utilisation de ces poissons pour la fabrication de farine n'est généralement pas rentable, car les quantités sont peu importantes. Il serait néanmoins utile de comparer les espèces non commercialisables dans les divers pays, étant donné que les préférences semblent différer sensiblement.

91. Pour les espèces pélagiques, les quantités rejetées à la mer sont considérables, en particulier lorsque la loi impose des tailles minimales, comme il en est pour les sardines en Israël, en Egypte et en Grèce.

92. Un minimum légal au débarquement ou à la commercialisation supérieur à la longueur de rétention à 50 pour cent pour l'engin considéré a toutes chances de conduire à la pratique du rejet à la mer s'il est effectivement mis en application; or, il y a de réels avantages à contrôler la taille à la capture en adoptant des réglementations correspondantes, ainsi que le fait Israël.

VI. EVALUATION DES STOCKS

A. Modèles globaux de production

93. Le Secrétaire technique a examiné les méthodes actuellement disponibles pour établir des modèles de la production totale d'une pêcherie en fonction de l'intensité de la pêche ou de la mortalité par pêche. Ceux-ci peuvent être utilisés pour l'évaluation de stocks multispécifiques ou monospécifiques, mais certaines données sont nécessaires à cet effet, à savoir:

- une série de données sur un effort de pêche normalisé pour un nombre important d'années;
- des études de stocks unitaires ou de populations denses.

94. Ces dernières années, des modèles de production complexes ^{1/} ont été mis au point en utilisant des données recueillies simultanément pour toute une série de zones unitaires ayant une productivité de base analogue; ils permettent de comparer l'intensité de la pêche (effort/zone) avec le taux moyen de capture. Cette approche a récemment été employée dans la Méditerranée occidentale et elle a permis en particulier de préparer un atlas des pêcheries^{2/}. Dans la Méditerranée orientale, les données israéliennes sembleraient utilisables pour établir un modèle de ce type.

95. Dans d'autres variations des modèles de production ^{3/}, on utilise les données relatives au taux de mortalité totale à la place des données sur l'effort de pêche lorsque celles-ci ne sont pas disponibles.

96. De manière générale, les modèles de production sont également difficiles à ajuster lorsque l'intensité de la pêche est déjà élevée et lorsque leur applicabilité générale est douteuse par suite de fluctuations marquées de la production d'une année à l'autre.

B. Modèles analytiques

97. On a commencé à évaluer les taux de croissance et de mortalité dont la connaissance est nécessaire pour appliquer les modèles de rendement par recrue (Y/R) et une estimation des effets relatifs des modifications de la mortalité par pêche et de la taille à la capture a déjà pu être faite pour plusieurs pêcheries. Etant donné que: Rendement potentiel = $(Y/R) \times \bar{R}$, où $\bar{R}$ est le nombre moyen de recrues, il est très important d'estimer le recrutement spécialement lorsque l'effort de pêche est important.

98. Jusqu'à aujourd'hui, les calculs de Y/R font défaut pour la Méditerranée orientale, mais on peut prévoir, sur la base des résultats concernant d'autres zones, que ces calculs permettront de prévoir une augmentation du rendement de nombreuses espèces lorsque la taille des poissons sera plus grande au moment de la capture et/ou lorsque l'intensité de la pêche diminuera.

99. La baisse de production des classes d'âge déjà recrutées (yield overfishing) n'est que l'un des aspects du problème. Le déclin du recrutement moyen par exploitation et réduction excessives du stock parental (recruitment overfishing) est également ou plus grave; il est lié à la réduction du nombre de recrues résultant d'une exploitation intense avant que la taille à la maturité ait été atteinte.

^{1/} Caddy, J.F. and S. Garcia, Production modelling without long data series. En 1983 National reports and selected papers presented at the Third Session of the Working Party on assessment of marine fishery resources of the Western Central Atlantic. FAO Fish.Rep./FAO Rapp.Pêches/FAO Inf.Pesc (278)Suppl:309-13

^{2/} Charbonnier, D. et/y/and S. Garcia (eds), Atlas des pêcheries de la Méditerranée occidentale et centrale. Atlas de las pesquerías del Mediterraneo occidental y central. Atlas of the fisheries of the western and central Mediterranean. Rome, FAO, CGPM/GFCM, CEE/EEC, pag.var.

^{3/} Csirke, J. and J.F. Caddy, Production modelling using mortality estimates. 1983 Can.J.Fish.Aquat.Sci., 40(1):42-51

C. Approches semi-quantitatives

100. Il peut être utile d'estimer la production par unité de superficie de différents fonds de pêche sur l'ensemble de la zone, en vue d'effectuer des comparaisons à l'échelle de la Méditerranée. A cet effet, il est nécessaire d'établir des cartes montrant le type de fond et la profondeur des diverses zones, ainsi que les fonds de pêche exploités, et d'estimer la production (en particulier d'espèces démersales et d'invertébrés benthiques commerciaux) par unité de superficie. Dans d'autres zones, les estimations ont donné des résultats raisonnablement semblables pour des habitats semblables.

D. Prospections effectuées par des navires de recherche

101. La conduite de prospections par des navires de recherche en vue de déterminer directement la biomasse est une autre méthode possible (utilisable aussi à titre complémentaire) qui, jusqu'à aujourd'hui n'a été employée qu'à Chypre. On peut appliquer par exemple un système d'enquêtes transversales périodiques (indiquant les modifications relatives de la biomasse d'une année à l'autre) ou un système d'échantillonnage aléatoire stratifié. Par ailleurs, il est souvent indispensable d'entreprendre des enquêtes sur les recrues ou sur les pré-recrues.

VII. CONCLUSIONS GENERALES ET EXAMEN CRITIQUE DES METHODES D'EVALUATION ET DES PRIORITES EN MATIERE DE RECHERCHE DANS LA MEDITERRANEE ORIENTALE

102. Les échanges de vue sur le point VI ont indiqué qu'il faudrait donner la priorité aux aspects ci-après de l'évaluation des stocks de la Méditerranée orientale:

103. La priorité absolue doit être donnée aux questions suivantes:

(i) Echantillonnage et analyse

Il faudrait recueillir dans l'ensemble de la Méditerranée orientale des données de meilleure qualité sur les captures par espèce et par zone de pêche et mettre au point des programmes d'échantillonnage en vue de déterminer les fréquences de taille et d'âge des principales espèces.

(ii) Approches semi-quantitatives

La préparation de cartes nationales des zones de pêche est un préalable indispensable d'une analyse détaillée. Ces cartes pourraient indiquer les zones de pêche par principaux types de fonds marins, les zones (saisonnièrement) exploitées, le nombre et l'emplacement des ports et, pour chaque port, le nombre et le type de bateaux et d'engins de pêche.

(iii) Cette approche pourrait conduire directement à l'application de modèles de production complexes.

- (iv) Il serait souhaitable de poursuivre l'estimation des paramètres dont la connaissance est nécessaire pour appliquer un modèle de rendement par recrue, et d'effectuer les calculs pour diverses combinaisons de paramètres dans les cas où il n'existe pas d'estimations antérieures. Des clés âge/longueur devraient être construites en vue d'améliorer l'échantillonnage.
- (v) Les modèles de fécondité par recrue seront utiles pour déterminer les effets des modalités actuelles de la pêche sur le recrutement futur. On aura besoin de meilleures estimations de la reproduction et du recrutement, et de l'âge correspondant; idéalement, il faudrait effectuer des estimations du recrutement partiel à une certaine taille et de la fécondité partielle par saison. Le nombre d'oeufs produits par femelle serait également utile pour calculer les taux de remplacement.
- (vi) Des enquêtes sur les pré-recrues devraient être envisagées si l'on dispose d'un navire de recherche.

104. Une moindre priorité est accordée aux modèles de production en général et aux études trophiques, quoique les universités soient susceptibles d'apporter une intéressante contribution à cet égard.

VIII. PRIORITES EN MATIERE DE RECHERCHE ET D'AMENAGEMENT - PROBLEMES ET RECOMMANDATIONS

105. Dans un seul pays, Israël, il semble que les captures des chalutiers soient restées assez stables, ce qui suggère que l'on est proche du rendement maximum équilibré (MSY); par contre, en Grèce et à Chypre, malgré l'accroissement de l'effort de pêche ces dernières années, les quantités débarquées ont parfois diminué et certaines espèces nobles sont devenues rares. Il est donc évident qu'il existe un certain degré de surexploitation, sans aucun doute à la fois économique et biologique, et que cette situation n'a pu être maintenue (et favorisée) que par une hausse des prix. Paradoxalement, la baisse récente des prix du carburant aura probablement pour effet d'accentuer la surexploitation biologique si le nombre de licences délivrées n'est pas limité. En Egypte et en Turquie, la situation est beaucoup moins claire et un important travail de base est indispensable pour recueillir les données statistiques nécessaires sur la biologie des pêcheries et la production.

106. En général, il faudra étudier en priorité quelques espèces principales, à savoir:

- Priorité 1: Merluccius merluccius
Mullus barbatus
Pagellus erythrinus
- Priorité 2: Spicara maena
Boops boops
Saurida undosquamis

107. A l'échelle nationale, il est suggéré de donner la priorité aux études suivantes:

A. Recherche à l'appui de l'aménagement

- Chypre - Etudes complémentaires de la dynamique des populations des espèces les plus importantes;
 - Enquêtes sur les pré-recrues et prospections acoustiques;
 - Etudes sur l'identité des stocks.
- Egypte - Amélioration des statistiques de base;
 - Etudes sur le mullet de roche.
- Grèce - Etablissement de modèles de production pour le merlu et le mullet de roche;
 - Etablissement de cartes des ressources de la côte occidentale et de la mer Egée;
 - Prospections acoustiques (mer Egée et eaux situées au large de la Crète;
 - Estimations des paramètres biologiques et dynamiques pour l'espadon et pour d'autres espèces hautement migratoires.
- Israël - Amélioration des bases de données, en particulier sur les aspects biologiques.
- Turquie - Estimations préliminaires des paramètres biologiques.
- CEE - Le représentant de la Communauté économique européenne a fait ressortir l'intérêt porté par la CEE aux aspects pratiques de l'aménagement des pêches dans la zone du CGPM. La CEE accorde beaucoup d'importance aux pêcheries de la mer Méditerranée et à l'exploitation rationnelle de leurs ressources. Elle l'a fréquemment montré en finançant des recherches sur diverses questions entreprises, soit directement par les Etats Membres (par exemple la Grèce), soit avec la coopération de la FAO et, plus particulièrement, du CGPM. Par ailleurs, le Parlement européen a plusieurs fois jugé souhaitable d'établir une politique de pêche commune dans la Méditerranée, ainsi qu'il a déjà été fait dans l'Atlantique Nord-Est. En conclusion, le représentant de la CEE a déclaré que les difficultés à résoudre pour atteindre cet objectif sont connues de tous et il a estimé que l'on aura de meilleures chances d'y parvenir lorsque l'on aura recueilli suffisamment de données scientifiques.

B. Aménagement

- Chypre - Il faudrait réduire le nombre de chalutiers opérant dans les eaux territoriales;

- Il serait souhaitable d'appliquer des mesures expérimentales d'aménagement prévoyant la fermeture de la pêche dans certains golfes pendant un à deux ans, en vue de se rendre compte du potentiel de récupération des stocks;
- Le maillage devrait être porté à 40 mm;
- Il faudrait mettre au point d'autres méthodes de capture de Spicara maena.

Egypte - Une haute priorité devrait être donnée à la formation de responsables de l'aménagement des pêches;

- Il faudrait améliorer la coopération entre le gouvernement et les pêcheurs.

Grèce - Il faudrait instituer à titre expérimental des zones/saisons de fermeture et d'ouverture de la pêche;

- Il faudrait accroître le maillage;

- Il faudrait limiter le nombre de licences délivrées.

Turquie - La délimitation des zones côtières (locales) d'interdiction du chalutage devrait être modifiée.

IX. DATE ET LIEU DE LA PROCHAINE CONSULTATION

108. Les participants ont été d'avis que la Consultation avait été extrêmement utile et qu'il faudrait organiser une deuxième réunion. Celle-ci devrait être tenue dès la fin de 1987 pour permettre d'évaluer les progrès accomplis dans l'application du programme de travail qui a été adopté. La période octobre-décembre a été recommandée et cette proposition sera soumise pour approbation au CGPM à sa dix-huitième session qui se tiendra à Monte-Carlo du 6 au 10 octobre 1986.

109. La Consultation a laissé à la dix-huitième session du CGPM le soin de suggérer le lieu de la deuxième consultation.

X. ADOPTION DU RAPPORT

110. Le rapport de la première Consultation technique sur l'évaluation des stocks de la Méditerranée orientale a été adopté le 10 avril 1986.

ANNEX A

Agenda

1. Opening of the Consultation
2. Adoption of the Agenda
3. Election of the Chairman and Vice-Chairman
4. Description of main fisheries
 - 4.1 Fleets
 - 4.1.1 Artisanal fisheries
 - 4.1.2 Industrial fisheries (pelagic and demersal)
 - 4.1.3 Size and composition of the fleets (statistical figures)
 - 4.2 Data available on catches by fishery and sector
 - 4.2.1 Discussion on statistical systems
 - 4.2.2 Catches per species
 - 4.2.3 Catches per unit of effort
 - 4.2.4 Length frequency distributions in catches
5. Estimates available on biological and dynamic parameters on main stocks
 - 5.1 Length/Weight relationship
 - 5.2 Growth
 - 5.3 Reproduction
 - 5.4 Mortality
 - 5.5 Recruitment
 - 5.6 Selectivity - selection factor
 - 5.7 Main demersal fish communities
 - 5.8 Other information
6. Stock assessment
 - 6.1 Global production models
 - 6.2 Analytical models
 - 6.3 Semi-quantitative analogical methods
 - 6.4 Overall conclusions on the potential and state of stocks in the Eastern Mediterranean
7. Critical review of assessment methods in the Mediterranean context
8. Problems met and recommendations regarding
 - 8.1 Research
 - 8.2 Management
9. Date and place of the next Consultation
10. Adoption of the report

ANNEXE A

Ordre du Jour

1. Ouverture de la Consultation
2. Adoption de l'ordre du jour
3. Election du Président et du Vice-Président
4. Description des principales pêcheries
 - 4.1 Flottes
 - 4.1.1 Pêche artisanale
 - 4.1.2 Pêche industrielle (pélagique et démersale)
 - 4.1.3 Taille et composition des flottes (données statistiques)
 - 4.2 Données disponibles sur les captures, par type de pêche et par secteur
 - 4.2.1 Examen des systèmes statistiques
 - 4.2.2 Captures par espèce
 - 4.2.3 Captures par unité d'effort
 - 4.2.4 Distribution des fréquences de longueur des captures
5. Estimation existantes sur les paramètres biologiques et dynamiques des stocks principaux
 - 5.1 Rapport longueur/poids
 - 5.2 Croissance
 - 5.3 Reproduction
 - 5.4 Mortalité
 - 5.5 Recrutement
 - 5.6 Sélectivité - facteur de sélection
 - 5.7 Principales communautés de poissons démersaux
 - 5.8 Autres informations
6. Evaluation des stocks
 - 6.1 Modèles globaux de production
 - 6.2 Modèles analytiques
 - 6.3 Méthodes analogiques semi-quantitatives
 - 6.4 Conclusions générales quant au potentiel et à l'état des stocks de la Méditerranée orientale
7. Examen critique des méthodes d'évaluation dans la mer Méditerranée
8. Problèmes rencontrés et recommandations concernant
 - 8.1 La recherche
 - 8.2 L'aménagement
9. Date et lieu de la prochaine consultation
10. Adoption du rapport

ANNEX(E) B

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ANNEX(E) C

National Report on Cyprus Fisheries

by

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Fisheries Department, Nicosia, Cyprus

Description of main fisheries

I. Fleets

A. Artisanal Fisheries (1984)

The fleet consists of 477 boats of 8-42 ft OAL. Of these boats, 190 are full-time, 106 are part-time, and 181 are occasional.

A number of 915 fishermen are engaged in the artisanal fishery as follows: 343 are full-time, 220 are part-time, and 352 are occasional.

B. Industrial Fisheries

(a) Demersal

This fishery consists of 10 trawlers of 66.6-93.1 ft (OAL) of 180-600 HP diesel engines. They are all stern trawlers, of steel or wooden hull.

Two of these trawlers of 56.8 ft and 93.1 ft OAL and 180 HP and 600 HP engines respectively are fishing exclusively in international waters.

The trawlers were built between 1955 and 1964 and the engines between 1955 and 1974.

Besides the two trawlers fishing exclusively in international waters, 4-6 trawlers, licensed for Cyprus waters, are also fishing in international waters usually during the summer months from June to October, during the closed season for trawlers in the territorial waters of Cyprus.

(b) Pelagic

The fleet consists mainly of boats of the artisanal fishery, which are occupied in the swordfish fishery mainly from April to October.

II. Data on catches by fishery and sector

A. Catches per species

Industrial fisheries: they are given in Tables 1 and 2.

Artisanal fisheries: they are given in Table 3.

B. Catches per unit effort of trawl fishery for the years 1978-84 are given in the following table (catch of all boats/day, in kg).

	1978	1979	1980	1981	1982	1983	1984
All species	240	225	192	210	248	369	373

C. Catches per unit effort of inshore fishery for the years 1978-84 are given in the following table (average catch/day/boat, in kg).

	1978	1979	1980	1981	1982	1983	1984
All species	11.8	13.3	15.2	15.3	14.9	19.6	19.6

D. Catches per unit effort of pelagic fishery for the years 1978-84 are given in the following table (catches of all boats/day, in kg).

	1978	1979	1980	1981	1982	1983	1984
Swordfish	228.7	228	226	252	253	188.0	234

III. Recent developments in the fishery

In 1981 new management measures were introduced in the fishery. The main measure was the extension of the closed season for trawling from four months (June-September) to five months (June-October). This new measure has, as a result, a substantial increase in the catch of both trawl and inshore fisheries, as the following figures show:

The trawl fishery catch in 1981, the year before the implementation of the new measures, was 238 t. In 1982, first year of the implementation (at the end of 1982), the catch increased to 266 t, and in 1983 reached 440 t, and 453 t in 1984.

The inshore fishery catch in 1981 was 810 t. In 1982 it increased to 858 t; in 1983 it reached 1,221 t and in 1984 1,448 t.

TABLE 1
Trawl Fishery Production 1978-83
Cyprus waters (in kg)

	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>
Red mullet	8,563	9,408	3,366	3,468	4,467	7,500
Pandora	19,315	15,500	6,419	8,038	8,153	7,334
Striped mullet	39,961	35,225	20,224	27,891	41,280	61,286
Bogue	12,134	12,326	12,877	7,270	5,158	9,267
Hake	1,484	537	576	550	371	1,190
Grouper	435	396	755	614	473	499
Comber	6,092	1,613	25	13	-	525
Lizard fish	806	1,305	-	-	-	-
Scorpion fish	2,329	601	-	64	-	-
Picarel*	226,419	225,779	163,942	157,645	178,112	308,224
Shark, dogfish, skate, ray	3,072	857	1,843	166	115	345
Octopus	24,307	28,224	21,453	18,419	19,865	22,144
Squid & cuttlefish	19,174	19,520	18,509	17,100	14,451	20,377
Shrimp	-	256	2,918	2,803	307	3,302
TOTAL	<u>364,091</u>	<u>351,547</u>	<u>252,907</u>	<u>244,041</u>	<u>272,752</u>	<u>441,993</u>

*Note: The figures for this species include substantial quantities of small Mullus barbatus which is sold at the same prices as Maena smaris and the commercial trawlers have difficulties in providing separate statistics

TABLE 2
Swordfish production 1978-83
(in kg)

	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>
Swordfish	90,718	108,526	78,790	88,322	123,840	32,830

TABLE 3
Inshore Fishery Production 1978-83
(in kg)

	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>
Red mullet	62,092	46,412	45,734	69,440	67,737	87,603
Striped mullet	41,753	33,536	28,403	45,965	51,430	55,334
Common sea-bream	10,956	10,432	12,800	19,059	18,573	16,076
Common dentex	21,324	34,291	42,969	28,595	31,206	33,587
Pandora	15,065	8,025	8,000	11,430	7,987	9,971
Bronze bream	15,347	7,308	13,760	10,035	30,246	21,030
Striped bream, saddled bream	5,184	9,280	10,368	9,049	10,092	10,009
Grey mullet	1,779	1,933	845	3,904	4,774	6,336
White bream, 2-banded bream	47,321	51,148	56,665	61,017	57,344	63,436
Bogue	95,820	129,241	119,961	126,412	150,387	216,550
Corb brown meagre	3,149	2,969	2,304	4,300	2,764	5,120
Salema	1,549	1,587	1,369	3,955	1,843	3,878
Amberjack	7,500	7,603	11,405	11,481	25,638	25,625
Atlantic little tuna	10,675	17,100	16,780	21,951	32,921	17,075
Groupers	13,798	41,561	47,040	35,328	27,622	28,864
Parrot fish	18,048	16,601	18,764	14,323	19,110	26,124
Blotched picarel	4,083	4,556	19,993	8,179	25,728	39,693
Picarel	18,304	56,806	76,761	86,541	76,915	153,664
Painted comber	6,003	4,864	8,166	3,865	4,595	2,777
Scorpion fish	11,852	8,000	15,206	11,507	5,337	6,336
Spine foot	12,019	9,881	14,080	19,443	23,424	23,040
Comber	8,960	5,593	12,262	8,499	8,192	6,963
Crawfish Med. locust lobster	1,830	591	691	1,561	384	780
Shrimp	332	51	141	448	345	973
Octopus	39,987	37,952	35,597	39,526	32,742	156,800
Squid & cuttlefish	44,326	37,696	33,817	50,265	49,446	68,902
Sharks, dogfish, ray, skate	13,209	10,880	17,293	17,331	16,076	13,017
Unsorted	118,976	92,966	109,580	105,817	100,979	151,014
TOTAL	<u>651,251</u>	<u>688,986</u>	<u>790,754</u>	<u>829,227</u>	<u>884,137</u>	<u>1,250,577</u>

ANNEX(E) D

A Review of Egyptian Mediterranean Fisheries

by

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I. INTRODUCTION

The Egyptian Mediterranean Sea coast is about 950 km long. The width of the eastern continental shelf is greater than that in the west, except in Salloum Bay. The maximum width is in front of the Nile delta and the narrowest area is located in the west near El Alamein. The continental shelf is composed of silty mud and muddy sands.

There are four lakes connected with the sea: Edku, Borollos, Manzala and Bardawill. The last one has high salinity while the others have brackish water.

There are 15 fishermen's cooperatives along the coast which produce most of the catches. The total capital assets of these cooperatives is L.E. 44 330. The number of fishermen is approximately 21,600.

The vessels which operate in this area are 1,421 with HP between 10 and 230; 44 percent have engines less than 70 HP.

The total annual production for Egypt is about 211 000 t (all seas, brackish and inland waters).

II. THE EGYPTIAN MEDITERRANEAN FISHERIES

We can divide the Egyptian Mediterranean coastline into three zones:

1. Western (450 km, from Alexandria to Sallum)

There is only one well equipped port situated at Matrouh.

The sea bottom is rocky and very dangerous for trawling. There are no fishing structures on land, especially as regards refrigeration, storage and workshops. Fishing boats number 15 (10 HP to 45 HP). They use longlines and drift nets.

2. Central (Alexandria to Port Said: 300 km)

Port Said is the best equipped port for fishing along the whole Egyptian Mediterranean coast. Alexandria needs developing.

The sea bottom in this area is muddy and suitable for bottom trawling.

Most of the fishing operations are concentrated in this area and more than 80 percent of the total catch comes from it.

3. Eastern (Port Said to Rafah: about 180 km)

The sea bottom is rocky except in front of El Arish. There are three main cities: El Arish, Ras El Abd and Rafah. The population living in these cities depends completely on fishing, especially in Lake Bardawil. There is now a plan to build a fishing port within the commercial port of El Arish.

The main fishing gear and methods are: demersal trawling, beach seines, drift nets, trammel nets, longlines and purse seines.

III. CONCLUSIONS OF A TRAWL AND PELAGIC SURVEY MADE IN 1984 AND 1985 ON THE EGYPTIAN COAST OF THE MEDITERRANEAN BY AN ITALIAN RESEARCH VESSEL

The conclusions of this survey, which was made at the request of the Egyptian authorities, are the following:

1. The ecological conditions in general cannot be considered as stable and this indicates further changes in the next few years.
2. As regards pelagic species, the presence of young stages but the scarcity of adults means that the stock would seem to be modest.
3. Fishing techniques with mid-water trawls do not seem suitable for the capture of small-sized shoals.
4. The large pelagic fish such as tuna and swordfish could provide interesting results in certain months and areas.
5. Demersal resources in deep waters gave more positive results than in previous surveys.
6. Understanding the dynamics of the species present demonstrates different possibilities for further fishing.
7. High predation could be at the root of the absence or scarcity of some crustacean decapods in deep water, and also demonstrate high natural mortality rates.

8. The presence of a large number of predators in many areas indicates that these resources are not caught by fishing gear.
9. The most promising investment would certainly seem to be in longline fishing.
10. The exploitation of these resources at a depth of more than 150 m with high techniques using big and medium-sized boats could start now.
11. The resources will need further long-term study.

IV. ROLE OF THE GOVERNMENT

The manpower in the Mediterranean sea region is about 260,000 fishermen.

The total population who work in the fishing industry in the Mediterranean is about 75 000.

The Egyptian Government is considering the establishment of a national policy for development through the following agencies:

1. The General Authority for Fish Resources Development

This Authority is responsible for the formulation of the national policy; its main functions are the preparation, administration and management of fisheries, collection of fishery statistics, legislation, licensing for vessels, supervising and controlling cooperative fishermen's societies. There are special divisions for fish farming, finance, research and investigation. The cooperative fisheries division provides devices and gear to the fishermen. There are technical schools for fisheries in Alexandria and Damietta.

2. The Institute of Oceanography and Fisheries

This Institute plays a major role in developing the fishing industry. More attention is given to applied than to academic research. The research of the Institute is directed towards:

- exploitation of new fishing grounds,
- stock assessment,
- fishing technology,
- marine biological, hydrographic and ecological studies,
- regulations to control and manage fisheries.

3. The Department of Coastal Guards, Ministry of Defence

The basic function of the Department is security.

V. PROBLEMS AND OBSTACLES FACING THE FISHING INDUSTRY IN EGYPT

- Effects of the High Dam on Mediterranean fisheries,
- restricted areas due to military security,
- illiteracy of the majority of the fishermen,
- absence of fishing maps,
- lack of modern equipment and new techniques,
- need for more training and education courses for cooperative fishermen,
- technical training in fish farming,
- a requirement for a good statistical system exists, including economic data and analysis,
- research on mesh selectivity,
- planning for the fisheries sector and fishing management,
- financing to face all requirements for improving this industry.

In addition, increased cooperation between FAO and the technical fisheries schools in Alexandria and Damietta would be helpful.

TABLE 1

Production as compared to fish stocks
(from the fish statistics for 1985)

Fishing area	Catches (tons)	Fish stock (tons)	Target to 1991	Most important species of fish caught	
1. Mediterranean Sea	20 000	60 000	30 000	Sardine	30%
				Sepia	18%
				Sea bream	15%
				Shrimp	5%
				Lizard fish	10%
				<u>Epinephelus</u>	10%
				and others	
				Red mullet	12%
2. Gulf of Suez and Red Sea	20 000	55 000	25 000	Sardine	50%
				Sea bream	10%
				Red mullet	15%
				Shrimp	5%
				Lizard fish	15%
				<u>Epinephelus</u>	5%
				and others	
3. Manzala Lake	50 000	300 000	120 000	<u>Tilapia</u>	70%
4. Borullos Lake	15 000			Grey mullet	25%
				Shrimp and others	5%
5. Edko Lake	5 000	}		<u>Tilapia</u>	80%
6. Mariut Lake	6 000			Nile perch	15%
7. Karoun Lake	2 000			Others	5%
8. Wadi El Rayan Lake	1 000				
9. Bardawill Lagoon	2 500				
10. Nasser Lake	25 000	25 000	80 000	<u>Tilapia</u>	80%
				Nile perch	15%
				Others	5%
11. The Nile and its branches	25 000	50 000	30 000	<u>Tilapia</u>	80%
				Catfish	20%
12. Fish farms	30 000	30 000	50 000	<u>Tilapia</u>	30%
				Grey mullet	30%
				Carp	40%
13. Others	3 000				
14. Consumption by fishermen	6 500				
	211 000		335 000		

TABLE 2

Fish landings (tons) in the main fishing centres
along the Mediterranean coast of Egypt - (1980-85)

Main fishing centres	1980	1981	1982	1983	1984	1985
Alexandria	3 543	2 741	3 158	2 866	3 123	3 585
Abukir	1 021	1 344	2 262	2 414	2 249	1 487
El Maadia	262	301	202	500	1 500	2 000
Rashid	313	263	189	190	400	600
Damiette	6 898	6 800	7 200	6 600	7 800	6 600
Port Said	4 824	3 750	3 600	3 086	3 500	3 616
El Arish and Bardawil	2 464	2 220	2 500	2 401	2 245	2 500
Other small fishing centres	602	704	500	380	580	580
	19 930	17 973	19 611	18 937	19 292	20 968

TABLE 3

Fish catches (tons) by main fishing gear (1985)

Trawling	9,400
Purse seine and sardine nets	7,500
Trammel net	600
Veranda net	250
Handline	1,018
Others	2,000
TOTAL	20,958

TABLE 4

Catch composition (tons) in the Mediterranean (1985)

Sardine	6,600
Blue fish	500
Sea bream	700
Red mullet	3,000
Red bream	1,500
Shrimp	1,200
Others (including crabs and mussels)	8,470
	21,970

TABLE 5

Motorized fishing boats in the main fishing centres (in HP), 1985

The centres	10-25	25-50	50-75	75-100	100-125	125-150	150-230	More than 230	Total
Marsa Matrauh	10	5	-	-	-	-	-	-	15
Alexandria	149	30	11	-	8	-	32	2	232
Abukir	107	71	-	19	-	12	34	-	243
El Maadia	10	35	-	15	61	13	42	-	176
Rashid	-	5	14	21	4	19	7	-	70
Idku	10	-	-	4	30	16	-	-	60
Damietta	33	60	8	4	51	146	155	4	461
Port Said	10	40	12	8	32	15	43	-	160
El Aris	-	4	-	-	-	-	-	-	4
TOTAL	329	250	45	71	186	221	313	6	1,421

ANNEX(E) E

The Mediterranean Fisheries of Israel

by

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Summary

This paper presents general information on the Israeli Fishery in the Mediterranean, providing data on infrastructure, fleet composition, fishing effort, catches and management policies. Trends in the Israeli Fishery, the potential of some underexploited stocks and proposals for regional cooperation in stock assessment and management are also briefly discussed.

INTRODUCTION

The Israeli Mediterranean fishery operates over the continental shelf adjacent to the Israeli shore and down to depths of about 200 fathoms. By definition, it may be considered an artisanal fishery, operating small, fishermen-owned vessels, representing a capital investment from a few thousand dollars for the smallest fishing unit up to about 300,000 dollars for an up-to-date trawler. Fishing is carried out within a radius of at most 5-6 sailing hours to the nearest shelter and even the biggest trawlers never stay at sea more than 3-4 days.

1. Infrastructure

1.1 Harbours and shelters

The central fishing harbour is situated at Haifa (Kishon Fishing Harbour). Accessible to all types of fishing vessels, this harbour also provides a wide range of services to the fleet. A pier in the Ashdod commercial harbour is reserved for fishing vessels and serves mostly trawlers. Fishing harbours at Acco and at Jaffo serve mostly smaller vessels. There are also a number of shelters along the shore, frequented by boats of up to 12 t displacement.

TABLE 1
Fishing Harbours in Israel

Harbour	Sheltered water area (m ²)	Length of warfs (m)	Dredged depth (m)	Hinterland area (m ²)
Kishon	20,000	200	3.5	60,000
Acco	2,800	140	1.5	2,800
Jaffo	2,000	100	2	6,000
Ashdod	-	100	4	2,010

1.2 Services

The Kishon fishing harbour provides the services needed by the fishing fleet. These include:

- (a) Catch-handling facilities (cold storage and deep-freezing, flake ice supply, fish auction hall, pre-processing plant),
- (b) repair and maintenance services (mechanical and electrical workshop, carpentry, one 15-t crane, 500 m² roofed net-mending shed),
- (c) supply facilities (fuel, electricity and water piping, supply store, restaurant),
- (d) other facilities (60 storerooms for fishing gear, parking lots, fire-fighting equipment, office space, etc.).

Services provided at the other harbours are more restricted, but storerooms, a crane and some kind of supplies are available.

A R/T station at Jaffo serves exclusively the fishing fleet.

1.3 Administrative frame

Fisheries, including fish culture, comes within the jurisdiction of the Department of Fisheries in the Ministry of Agriculture. The department is divided into several sections; those relevant to the sea fisheries being:

- statistics,
- law enforcement (licensing and inspection),
- harbour administration,
- fishing technology (fishing gear and development of methods, surveys, monitoring), and
- fish technology (fish handling, product development, quality control).

Most fishermen boat-owners are organized within the framework of the Fishermen's Union, a statutory representative body which also provides several important economic services on a non-profit basis.

Registration of vessels and yearly, compulsory inspection for all types of vessels is carried out by the Directorate of Shipping in the Ministry of Transportation.

2. Fleet composition

For statistical and administrative purposes, the fishing fleet is divided into three branches:

- (a) inshore fishing,
- (b) pelagic fishing, and
- (c) trawling.

2.1 Inshore fishing vessels are mostly wooden boats (also some GRP) up to 10 m l.o.a. and powered by inboard or outboard engines of 6-40 HP. The larger vessels in this category are decked and fitted with a small wheelhouse. They fish by gill and trammel nets and longlines. Some of the boats carry echosounding equipment and gear-hauling devices.

2.2 Vessels in the pelagic fishery are between 11-m and 13-m long, of wooden construction, all fitted with hydraulic power blocks, echosounders and some with sonar and R/T equipment. They are mainly purse seiners, but fish also occasionally by gill and trammel nets.

2.3 Trawlers are between 14-m and 27-m long, powered by 180-300 HP engines, built of steel, although there are a few wooden and GRP vessels also. All trawlers have refrigerated fish holds, hydraulic trawl winches and, on some, net-drums. Electronics include colour echosounders and Radars, SSB and VHF R/T and, on some vessels, also colour sonars.

TABLE 2
Fleet Composition

	<u>No. of vessels</u>	<u>Total HP</u>	<u>Total tonnage</u>	<u>No. of fishermen</u>
Inshore	398	4,800	2,500	796
Pelagic	24	760	330	120
Trawl	20	4,000	1,400	119

3. Manpower

3.1 Employment

As already mentioned, all vessels are fishermen-owned and crewed. There are some hired hands in the trawl and pelagic fishery, but almost none in the inshore fishery. Inshore fishing boats are operated by two fishermen. Pelagic fishing vessels carry a crew of five and trawlers a crew of 3-4. The actual number of fishermen is higher than the product of the number of vessels multiplied by the number of crew, since most fishermen, especially on trawlers, work on a roster basis: two weeks at sea and one week on shore.

3.2 Some socio-economic factors

The average fisherman is 35-45 years old, fishing being his only or main source of income. The number of part-time fishermen is low, and there are no subsistence fishermen. Although recreational fishing is quite popular, it is outside the scope of this paper. It seems that lately, younger and better educated people are joining the trade.

There are large disparities between the income of different fishermen, even in the same branch, but generally speaking skilled and successful fishermen have earnings well above the national average for agricultural workers (not taking into account working hours and the hardship at sea).

3.3 Licensing

All fishermen have to carry valid, yearly renewable licences issued by the Department of Fisheries.

Operators of vessels up to 14 m l.o.a. have to pass examinations to receive a "small boat operator" licence. Operators of larger vessels have to pass examinations to receive a "limited skipper" licence.

4. Fishing gear

The following are the most common types of fishing gear used in the Israeli fishery:

4.1 Gill and trammel nets

These are mostly constructed from PA monofilament netting, although some small meshed gillnets are made from PA multifilament netting. According to season and species sought, they are either set floating or on the bottom in depths of up to about 35 fathoms. A boat may fish a fleet of nets up to 2,000 m long.

4.2 Longlines

These are used mostly over rocky bottom in depths down to 80 fathoms. A vessel may set up to 2,000 hooks. Lately a simple line hauling device has been developed which should enable fishermen to set their gear in depths of over 200 fathoms.

4.3 Purse seines

Purse seines are of the Mediterranean type: 250-300 m long at the float line, and up to 35 m working depth, made of fine nylon netting with a 20 mm mesh. A fishing unit owns usually one big and one smaller net, the latter used mostly for day fishing in very shallow waters. A purse seine with a 60 mm mesh, about 400 m long, is used to fish for little tuna. For fishing for sardines by night, gas fishing lamps totaling 6,000 candles on 2-3 light boats are used.

4.4 Trawls

The formerly dominant, low-opening Italian-type trawl has completely been replaced by a locally developed 4-panel trawl, effective both on fish and on shrimps. More recently, high-opening, Engel-type trawls and semi-pelagic trawls are being fished when conditions are suitable. The traditional rectangular doors are gradually being replaced by cambered, polyvalent-type doors.

4.5 Other types of fishing gear

Beach seines, once an important fishing gear, are rarely used any more. Because of urban developments, natural reserves close to the shore, recreational areas, etc., very few beaches are left for this fishery, but a single, mechanized beach seine is still being operated in Haifa Bay. A typical fishing gear is the "Tahwik," a kind of purse seine set over rocky bottom and closed by divers.

5. Catch and catch composition

5.1 Catch and fishing effort

There are no viable data on the fishing effort in the inshore fishery in terms of catch per day per fishing unit. It is estimated that the average yearly catch per boat with a crew of two is slightly above four tons of prime quality fish.

In the pelagic fishery, effort is defined as catch per vessel per day (or per night) at sea, not counting the number of sets made. By this account, the average fishing unit fishes for about 115 days per year, the average daily catch being 637 kg of fish.

Reliable data on the fishing effort in the trawl fishery are available due to a computerized monitoring programme allowing the calculation of catches per vessel per fishing day and per actual hour of trawling. The average trawler fishes for about 200 days per year (with some vessels exceeding 300 days at sea), catching 320 kg fish per day or 20 kg per hour of trawling.

TABLE 3
Catch and Effort 1984

	Total catch (t)	No. of fishing units	No. of fishing days	Yearly catch per unit (t)	Catch per unit effort (kg)	Catch per fisherman ^{a/} (t)
Inshore	1,550	398	-	4	-	2
Pelagic	1,750	24	2,745	73	640	13.5
Trawl	1,300	20	4,009	65	320	18.5

a/ Yearly production per crew member

5.2 Catch composition (see Table 4, next page)

The overall composition by species of the Mediterranean catch has remained more or less steady for many years, except in two major occurrences:

- the sardine catches, which fluctuated for years around the 1,000 t level, dropped sharply in 1977 to 340 t, steadying at 400-500 t up to 1981. Since 1982, stocks seemed to recuperate, providing yearly catches of 680 t in 1982, 870 t in 1983 and 1,030 t in 1984. Echosounding surveys carried out by the Department of Fisheries indicate that available stocks may be even greater, but it seems that, because of the low prices for sardines, fishermen prefer to purse seine for more valuable species;
- in the trawl fishery, the share of lizard fish (Saurida undosquamis), once approaching about 30% of the total catch, dropped steadily during the last three years, reaching an all-time low of 80 t - less than 6.5% of the catch in 1984.

6. Trends in the Israeli Fishery

Two major factors are at the root of the latest developments, namely:

- (a) limitation of fishing grounds, and
- (b) economic factors.

The first limitation of fishing grounds accessible to the fishermen was caused by geo-political changes, urban developments along the shore, establishment

TABLE 4

Catch Composition 1984

	<u>Inshore</u> <u>(t)</u>	<u>Pelagic</u> <u>(t)</u>	<u>Trawl</u> <u>(t)</u>	<u>Total</u> <u>(t)</u>
<i>Sardinella aurita</i>	10	1,026	-	1,036
<i>Saurida undosquamis</i>	-	-	80	80
<i>Merluccius merluccius</i>	-	-	90	90
<i>Epinephelus</i> spp.	300	-	30	330
<i>Seriola dumerilii</i>	50	40	-	90
<i>Trachurus</i> spp.	50	120	50	220
Other carangids	30	40	-	70
<i>Argirosomus regius</i>	15	-	15	30
Mullids	40	-	480	520
Boops boops	80	50	75	205
<i>Pagellus erythrinus</i>	-	-	78	78
Other Sparids	200	100	62	362
Lutianids	5	-	-	5
<i>Scomber japonicus</i>	25	80	-	105
<i>Euthynnus</i> spp., <i>Auxis</i> spp.	50	10	-	60
Siganids	250	30	10	290
Sphyraenids	30	70	52	152
Mugilids	300	100	-	400
<i>Solea solea</i>	10	-	12	22
Elasmobranchs	40	-	60	100
Shrimps	-	-	95	95
Others	65	84	111	260
Total	<u>1,550</u>	<u>1,750</u>	<u>1,300</u>	<u>4,200</u>

of restricted or closed areas and an increase in the number of obstructions (wrecks, dumping sites, etc.). Economic factors include the rising cost of fuel, imported fishing gear and of other supplies. It is therefore natural that the major development efforts were directed towards exploitation of every available fishing ground and fish stock and towards reduction of production costs. That means better fish detection and navigation equipment, more efficient and versatile fishing gear, reduction of fuel consumption and labour-saving mechanization of gear handling.

6.1 Electronics

Colour sounders have been fitted to all trawlers and to some purse seiners. They are now being introduced to the inshore fishery, permitting the setting of the gear close to reef, wrecks, etc.

Colour sonars are becoming common in the trawl fishery, where they are used to detect and avoid obstructions, thus enabling trawlers to fish on previously unaccessible grounds. In the pelagic fishery, they are used not only to detect fish schools, but also to estimate their size and composition.

6.2 Fishing gear

The fishing gear in the inshore fishery has not changed much since the introduction of monofilament netting. In the purse seine fishery, there is a tendency towards longer and deeper nets. In the trawl fishery, the trend is towards diversification of types of trawls, so that not only purely demersal fish, but also higher-swimming species may be caught. In this respect, the introduction of the high-opening Engel-type trawl and of semi-pelagic one-boat trawls was very successful.

6.3 Fuel consumption

The increasing price of fuel is affecting chiefly the fuel intensive trawl fishery. By fitting suitably designed propeller nozzles to all trawlers, fuel consumption has been reduced by 20-25%. A new and more efficient "slotted" nozzle is now undergoing trials. There is also a tendency to replace the traditional rectangular, flat trawl doors by cambered doors. Although definite data are not available yet, it seems that those doors reduce drag by some 5%.

6.4 Mechanization

Crews in every branch of the Israeli fishery are already very small and cannot be reduced any further. The aim of more mechanization of gear handling is now directed towards enabling fishermen to handle more fishing gear in a shorter time with less effort. Thus, by the use of net haulers, inshore fishermen can handle

very large fleets of nets in a most efficient manner without much manual labour. In the trawl fishery, double-barreled net drums now extensively used, permit, if fishing conditions warrant it, a quick change over from one type of trawl to another. Thus, whilst one drum hauls, say, a low opening trawl, an Engel-type trawl can be shot from the other one. Obviously, hauling time and the amount of manual labour involved are also reduced, with the added benefit of increased safety on board.

7. Management

7.1 State of stocks

Knowledge on the size of stocks of commercially important fish is very limited. Some Mullidae, penaeid shrimps, sardines and, to some extent, hake (Merluccius merluccius) have been subjects of biological studies, but the size of these stocks and the maximal sustainable yield have not been defined. Neither do we have a valid explanation for the collapse of the sardine fishery in 1977 and for its apparent recuperation since 1983. Analysis of statistical data seems to indicate that the common, demersal, commercial stocks are exploited near the maximum permissible level. Catches of some pelagic species, especially Scombrids and Carangids, could be increased, but the low market value of most of these fish does not attract fishermen to do so.

An as yet nearly unexploited stock is the Parapenaeus longirostris population, a small shrimp appearing in quantities during the summer months in depths of more than 40 fathoms. This population has been thoroughly studied and surveyed for a period of three years (1979-82). It is estimated that 300-400 t of this species could be caught in commercially profitable amounts between June to September, but there is hardly any local market for them. The exploitation of this stock depends therefore on the establishment of a processing plant, where the catch could be cleaned, peeled and packed for export.

Another unexploited species is the deep sea shark (Centrophorus granulosus) appearing in quantity in depths of more than 100 fathoms. Although the meat of this shark has very little value, its large liver is ideal for the production of squalene, a high-priced commodity. Extensive trials, both for developing adequate fishing techniques and the production process for pure squalene, have been carried out since 1982 and are still continuing.

Swordfish (Xiphias gladius) seems to be quite abundant from June to September over the slope of the continental shelf. During a fishing trial with floating longlines, some specimen of about 70 kg were caught. This stock ought to be further investigated.

7.2 Competition between fishing methods

The limited size of available fishing grounds, the increase in the number of inshore fishing boats and the introduction of sophisticated electronics which make possible the exploitation of every nook and cranny of the sea bed have caused a conflict of interests between fishermen operating passive fishing gear and those of the trawl fishery. In the inshore fishery itself, fishermen compete, not always on a fair play basis, for favoured spots to set their entangling gear. There is also an increasing competition between professional and recreational fishermen - although the latter are limited to certain fishing methods and gear sizes.

To minimize conflict of interest, to prevent unfair competition and, at the same time, protect stocks, adequate management measures and legislation became imperative.

7.3 Management and legislation

Fishery management measures enforced by the competent authorities up to now, were directed mainly towards a rational exploitation of the stocks of commercial fish, giving the fish a fair chance to reach reproductive maturity and to avoid overfishing. In the frame of this policy, the following measures were legislated and enforced:

- (a) minimum marketable sizes are prescribed by law for most of the important commercial species, so that they will not be caught before they can complete at least one reproductive cycle,
- (b) mesh size in the cod-end of trawls and in the bunt of purse seines are strictly regulated and enforced (48 mm stretched mesh in trawls and 20 mm in purse seines),
- (c) fishing by the use of explosives and poisonous substances is prohibited and transgressions are heavily fined,
- (d) obstruction of estuaries and river mouths which may prevent free movement of certain fish to their breeding or nursery grounds is prohibited.

(There are also some minor or less satisfactorily enforced rules and regulations.)

Due to developments already mentioned, additional management measures became necessary and are at present undergoing the legislative process. They are based on the assumption that to protect stocks and avoid overfishing the fishing effort has to be regulated and that each component of the fishery ought to have its fair share of the total catch. The new regulations will include:

- (a) limits to the number of trawlers and their aggregated horse-power,
- (b) limitation of the permissible engine horse-power on trawlers,
- (c) licensing, not only of fishing vessels, but also for the types of fishing gear they may use,
- (d) establishment of exclusive fishing areas for the inshore fishery, where any other fishing activity is prohibited.

Attempts are also made to improve the data base on which management policy is made, especially by collecting more accurate information on catch composition and on the geographical distribution of the fishing effort. Investigations are also under way to ascertain whether artificial reefs may contribute to the enrichment of sea life. To this purpose, an artificial reef, covering a 1,000 m² area, has been established and is continuously surveyed and monitored.

8. The need for regional cooperation

A large part of the fish populations in the Eastern Mediterranean, especially the pelagic ones, may be considered as stocks common to, at least, some other countries in the area. Very little is known about the dynamics of those populations, especially their size and migrational patterns. The study of this subject, at least for the most important species, (sardines, tuna and tuna-like fish, swordfish, etc.) ought to be carried out on a regional level by the interested countries according to a pre-agreed programme.

In this context, it seems justified to propose that, as far as common stocks are involved, unified management policies ought to be adopted. These may include a standardized data collection system, common minimum legal fish size and, where applicable, common minimum mesh size regulations.

Our knowledge of the demersal populations beyond the continental shelf is very limited. From trials carried out in this country, it seems that the population of sharks, some Serranids (Epinephelus caninus and E. haifensis), deep-sea shrimps (Aristeomorpha foliacea) and others may be of considerable size. As those areas are outside the territorial waters of most countries in the region, they may be considered as a common fishing ground, warranting first a coordinated research effort and, later, a common management policy.

The establishment of a permanent regional forum for exchange of information and for the sharing of experience would also benefit the countries involved.

ANNEX(E) F

Données techniques sur la pêche dans
les eaux territoriales grecques

par

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1. INTRODUCTION

La géomorphologie de la Grèce, dont les côtes marines ont une longueur de 15 000 km ainsi que le nombre des îles, qui dépasse les 2 000, a eu comme conséquence un contact intense des Grecs avec l'environnement marin, ainsi que le développement de la pêche et la navigation; la navigation a été fort développée, au contraire de la pêche qui a subi un développement faible; ceci est dû à la faible productivité de la Méditerranée à l'étroit plateau continental de la Grèce ainsi qu'au faible intérêt économique que la pêche représente en comparaison avec la navigation.

Les activités de pêche grecques se sont étendues au long des côtes africaines de la Méditerranée, ainsi qu'à l'océan Atlantique, Indien et au golfe Persique.

2. LA FLOTTE DE PECHE

Il est difficile de déterminer le nombre des bateaux de pêche, en particulier de pêche côtière. Les bateaux de pêche sont généralement très vieux (tableau 1). Ainsi: (a) 52,3% des bateaux de pêche ont plus de 30 ans et 19,5% plus de 40 ans, (b) il y a eu un intérêt important pendant les derniers 15 ans, relatif à la construction des bateaux nouveaux, qui a récemment cessé, (c) le renouvellement de la flottille s'effectue très lentement (25% tous les 10 ans: 15-20% pour les petits bateaux, 20-30% pour les plus grands).

3. PRODUCTION DE PECHE

Dans le tableau 2, on voit la production totale de la pêche des eaux marines et des eaux intérieures. Il en résulte une augmentation constante de la production de 1950 jusqu'à 1970. Malgré l'évolution constante de la technologie halieutique, la production de la pêche demeure constante à partir de 1974. Cette évolution se caractérise par deux tendances: une faible diminution de la production de la pêche en mer et une augmentation de la production de la pêche des eaux intérieures.

La diminution de la production de la pêche en mer s'explique par:

- (1) La disparition de la pêche méditerranéenne;
- (2) La forte diminution de la production de la pêche lointaine;
- (3) La diminution de la production des espèces pélagiques à cause d'une faible demande de ces dernières;
- (4) La baisse de la productivité des pêcheries grecques sans renouvellement de ces dernières;
- (5) La pollution des zones de pêche traditionnelles (golfs de Saronikos, de Thermaikos, etc.).

Cette diminution serait plus forte, si on n'améliorait pas la politique de la pêche (subventions économiques à partir de 1974, libération des prix des produits de la pêche à partir de 1979).

4. PERSONNEL DE LA PECHE

Selon des statistiques récentes, le nombre total des marins embarqués était de 26 800 en 1981 (tableau 3). Ce nombre diminue constamment (1960: 36 000), à cause des conditions difficiles auxquelles la pêche s'effectue, le faible rendement de la pêche, etc.

5. PECHERIES GRECQUES PRINCIPALES

5.1 Pêche artisanale

La pêche a été développée au long de toutes les côtes et, en particulier, des régions protégées (golfs et baies naturelles) et en des endroits plus réguliers du plateau continental. Elle s'effectue avec des petits bateaux de pêche et des barques, dont la taille varie de 4 à 15 m (surtout entre 4 et 10 m).

Le nombre total des chalutiers côtiers en 1981 était de 9 824; ce nombre, en comparaison avec celui de 1974, a augmenté de 11% (8 822). Ce nombre ne concerne pas les 12 000-14 000 bateaux de pêche d'une puissance motrice inférieure à 20 CV, ainsi que les amateurs (2 000 bateaux) et les bateaux sans moteur dont le nombre diminue constamment (1 279 en 1974; 784 en 1981).

Le taux de construction des senneurs et des palangriers a subi une faible diminution entre 1974-76; ceci est dû à l'augmentation du prix du gasoil et de la main d'oeuvre. Récemment ce taux a fort augmenté (14,6% entre 1977-81 et seulement 2% entre 1974-78) grâce à l'augmentation du prix des poissons de haute qualité, ainsi qu'à la libération des prix des poissons généralement.

La puissance motrice des bateaux de pêche côtière varie de 150 à 200 CV. On estime que 7% seulement de ces bateaux possède une puissance motrice supérieure à 100 CV. L'indice de puissance (CV/bateau) augmente constamment de 15 CV/bateau en 1974 à 24,2 CV/bateau en 1981.

Les engins de pêche principaux sont le filet droit, le filet maillant, la palangre, le chalut, la nasse, la drague, la senne et le filet tournant. Une réglementation de pêche existe pour la maille et la saison de pêche en ce qui concerne le chalut, le filet tournant et la nasse. Pour les autres engins de pêche, la réglementation est relative seulement à la taille des poissons.

Les espèces principales de la pêche côtière sont: des espèces de la famille des Sparidae, Mullus barbatus, Mullus surmuletus, Scorpaena sp., Epinephelus sp., Trachurus sp., Phycis phycis, Solea vulgaris, etc.

5.2 Pêche côtière

Les chalutiers et les senneurs effectuent, en principe, la pêche côtière. 36% des chalutiers sont licenciés comme bateaux de pêche bivalents (senneurs également).

Le nombre total des bateaux de pêche côtière a subi une augmentation de 3,17% entre 1974 et 1981 (avec un taux annuel de 0,45%). En réalité, il y a eu une augmentation de 9,5% pour les chalutiers et une diminution de 3,95% pour les senneurs. L'augmentation du nombre des chalutiers est dû à:

- la libération des prix des produits de la pêche à partir de 1979;
- l'intégration des bateaux de la pêche méditerranéenne à la pêche côtière (après l'interdiction de la pêche grecque sur les côtes de l'Afrique du Nord).

Le taux de construction des senneurs a subi une faible augmentation jusqu'à 1977; ensuite, on remarque une diminution de ce taux à cause de la stabilité du prix des espèces pélagiques d'une part et des mauvaises conditions de conditionnement et de commercialisation.

Le tonnage des bateaux présente une augmentation constante; de 21 670 tonnes en 1974 à 26 794 en 1981 pour les chalutiers et les senneurs également. La puissance motrice totale des chalutiers et des senneurs de la pêche côtière est estimée à 156 653 CV et 105 057 CV respectivement pour l'année 1981. La puissance motrice moyenne est de 262,7 CV pour les chalutiers, 163,3 CV pour les senneurs et 218,7 CV pour le total.

5.2.1 Chalutiers

Législation des dimensions des bateaux:

Longueur entre perpendiculaires	minimale	14 m
Largeur	"	5 m
Hauteur	"	2 m
Puissance motrice	"	80 CV

La pêche au chalut semble être déjà arrivée à son maximum de rendement; le rendement économique par bateau diminue constamment; ceci est dû à l'augmentation du coût de production et à la diminution de la productivité des pêcheries.

Espèces principales pêchées au chalut: Merluccius merluccius, Mullus barbatus, Pagellus sp., Micromesistius poutassou, Spicara sp., Trisopterus minutus capelanus, Trachurus sp.,

5.2.2 Senneurs

On distingue deux types: les senneurs de jour et les senneurs de nuit. Il n'y a pas des différences essentielles entre ces deux types, en ce qui concerne l'équipement, sauf qu'ils travaillent à des pêcheries différentes et qu'ils pêchent des espèces différentes; en outre, la taille et la maille du filet tournant sont différentes.

Dimensions du filet tournant:

	<u>Senneur de jour</u>	<u>Senneur de nuit</u>
Longueur	1 200 m	350-600 m
Largeur	90 m	80-100 m

La longueur des bateaux varie de 11 m à 20 m et la puissance motrice de 50 CV à 400 CV. La pêche de ce type, bien qu'elle ait le meilleur rendement en tonnage, a un rendement en valeur faible et variable, à cause de la faible valeur des produits de la pêche à la senne; par conséquent, le taux de renouvellement ainsi que de modernisation de la flottille des senneurs sont lents.

Les espèces principales pêchées à la senne sont: Sardina pilchardus, Engraulis encrasicolus, Trachurus sp., Sardinella aurita, etc.

5.3 Pêche méditerranéenne

Ce type de pêche (pêche au chalut en principe) a été développé après la deuxième guerre mondiale; les chalutiers pêchent sur les côtes de l'Afrique du Nord, au large des îles de la mer Ionienne et de la mer Egée. Auparavant, les chalutiers pêchaient le long des côtes de Libye.

L'activité maximale de ce type de pêche se situe à la période 1960-65 et on dénombre 46 chalutiers avec 8 000-10 000 t de production; le nombre de bateaux de pêche a diminué à partir de 1970, à cause des interdictions de pêche, ainsi que des limitations en ce qui concerne les licences de pêche; ce type de pêche a été interdit dans les eaux territoriales libyennes à partir de 1976. Le nombre de bateaux qui pêchent dans les eaux internationales, près des eaux territoriales libyennes, a diminué de 28 (1974) à 19 (1976).

TABLEAU 1
Bateaux de pêche côtière et lointaine par
échelle d'âge et d'indice de tonnage
(I.Tn)

<u>I.Tn</u>	<u>Inférieur à 10 I.Tn</u>	<u>11-40 I.Tn</u>	<u>41-70 I.Tn</u>	<u>71-100 I.Tn</u>	<u>Supérieur à 101 I.Tn</u>	<u>Total</u>
<u>Echelle d'âge</u>	%	%	%	%	%	%
Moins de cinq ans	-	5,67	10,71	20,52	4,25	7,31
5-9	-	7,40	23,97	25,64	26,60	13,88
10-14	-	4,30	14,28	7,69	12,77	6,89
15-19	2,13	3,72	4,76	2,57	11,70	4,53
20-24	2,13	6,80	2,98	20,52	8,52	7,31
25-29	10,64	8,01	4,17	12,82	6,38	7,72
30-34	14,89	23,20	19,65	2,56	5,32	18,83
35-39	17,00	17,04	10,72	2,56	9,57	14,09
Supérieur à 40 ans	53,19	23,02	3,57	2,56	6,38	17,69
Indéterminés	-	0,83	1,19	2,56	8,51	1,75
Total	100,00	100,00	100,00	100,00	100,00	100,00
Pourcentage par I.Tn	4,8	60,3	17,2	8,2	9,6	100,00

TABLEAU 2

Evolution de la production halieutique

<u>Années</u>	<u>Production totale (t)</u>	<u>Pêche en mer (Produits frais-congelés)</u>	<u>Pêche des eaux intérieures</u>
1950	66 000	-	-
1955	86 000	80 000	6 000
1960	93 000	86 000	7 000
1965	106 100	98 100	8 000
1970	133 000	122 000	11 000
1971	127 700	116 700	11 000
1972	130 900	119 900	11 000
1973	120 200	111 700	8 500
1974	120 266	115 761	4 505
1975	115 833	111 580	4 253
1976	116 048	110 657	5 391
1977	116 662	109 842	6 820
1978	109 367	101 122	8 245
1979	116 466	107 287	9 179
1980	117 180	108 160	9 020
1981	113 284	105 047	8 237
1982	115 500	102 500	13 000
1983	111 000	97 500	13 500
1984	117 500	103 500	14 000

TABEAU 3

Distribution du nombre des marins embarqués par type de pêche
et variation de l'indice de puissance (CV/bateau)
et de l'indice de tonnage (t/bateau) en 1981

<u>Types de bateaux de pêche</u>	<u>Nombre total des marins embarqués par type de pêche</u>	<u>Variation (%) de l'indice de puissance (CV/bateau)</u>	<u>Variation (%) de l'indice de tonnage (t/bateau)</u>
<u>Pêche artisanale</u>	<u>20 257</u>	<u>61,3</u>	<u>-</u>
Chalutiers de pêche cotière	2 101	50,0	18,4
Senneurs de jour	613	-	-
Senneurs de nuit	<u>2 721</u>	<u>34,7</u>	<u>21,6</u>
Total pêche cotière	5 435	45,9	20,7
<u>Chalutiers de pêche méditerranéenne</u>	<u>14</u>	<u>- 14,2</u>	<u>non calculée</u>
Chalutiers de pêche lointaine (sauf à la crevette)	710	- 2,1	- 3,2
Chalutiers de pêche à la crevette	280	16,9	2,8
Bateaux de transport	<u>60</u>	<u>91,2</u>	<u>1,0</u>
Total pêche lointaine	1 050	13,1	2,9
TOTAL GENERAL	26 756	29,1	- 12,0

ANNEX(E) G

Fishing Industry in Turkey

by

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1. INTRODUCTION

The state owns the fishery resources in Turkey. Uses of these resources and production output are governed by the Fisheries Products Law No. 1380 (1971). Principles of this Law are the continuous use and development of fishery resources, determining new catch areas and optimum use of stocks. Further, the use of fishery resources for the betterment of social and economical levels of people is among the most important factor determining the policies for the fishery sector in Turkey.

2. OUTPUT OF THE FISHERY SECTOR IN TURKEY

Total output of 160,000 t in 1971 has increased to 520,000 t in 1983.

2.1 Fisheries in the National Economy

The share of the fishery sector within the national economy was 0.4% in 1972. This seems a very small figure for a country like Turkey with great fisheries potential. It would be more correct therefore to evaluate the share of fisheries output within the agricultural sector instead.

From the population census of 1970, the number of people occupied in the agricultural sector is 13,387,873. The number of people occupied in fishing industry makes up only 170,610 of this figure. The population occupied by the fishing industry make up 0.48%, and the occupants of the agricultural sector 1.21% of our total population.

Sixty-one percent of the people involved in fishing industry are qualified fishermen, 24.1% of the fishermen are crew-members and 14.9% are unqualified labour.

Distribution of this population by regions is given in Table 1. As will be observed from the table, the region with least involvement in fishing is the Mediterranean with 5%, and the region with most involvement is the Black Sea with 35%.

TABLE 1

Distribution of population in fishing industry by regions (1976)

<u>Region</u>	<u>Percentage rate of distribution</u>
Black Sea	35.0
Sea of Marmara	29.2
Aegean Sea	16.4
Mediterranean Sea	5.5
Other	13.9

2.2 Fishing Boats

The number of boats was around 4,500 in 1976 and reached 7,500 in 1983. The reason for this increase is attributed to a new legislation which provided for building and equipping the fishing boats.

TABLE 2

Distribution of fishing boats

	<u>Aegean</u>	<u>Mediterranean</u>	<u>Total number of boats</u>
Trawlers	32	80	146
Purse seiners	257	79	1,026
Longliners-Gillnetters	598	497	3,258
Beach seiners	81	35	116
Others	<u>374</u>	<u>196</u>	<u>3,126</u>
Total number of boats	<u>1,342</u> =====	<u>887</u> =====	<u>7,672</u> =====

TABLE 3

Distribution of fishing boats
by type and engine power

	Motorized (HP)					Without engine	Total number of boats
	<u>1-9</u>	<u>10-19</u>	<u>20-49</u>	<u>50-99</u>	<u>100</u>		
Trawlers	-	-	-	-	146	-	146
Purse seiners	-	-	187	311	528	-	1,026
Longliners- Gillnetters	939	2,069	250	-	-	-	3,258
Beach seiners	-	-	94	22	-	-	116
Others	<u>2,793</u>	<u>13</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>320</u>	<u>3,126</u>
Total number of boats	<u>3,732</u> =====	<u>2,082</u> =====	<u>531</u> =====	<u>333</u> =====	<u>674</u> =====	<u>320</u> =====	<u>7,672</u> =====

TABLE 4

Number of fishing boats
by type and tonnage

	Tonnage class (m't)						Total number of boats
	<u>0-0.5</u>	<u>0.5-1.0</u>	<u>1.0-5.0</u>	<u>5.0-10.0</u>	<u>10.0-50.0</u>	<u>50.0+</u>	
Trawlers	-	-	-	-	143	3	146
Purse seiners	-	-	-	336	511	179	1,026
Longliners- Gillnetters	-	-	3,126	132	-	-	3,258
Beach seiners	-	-	-	103	13	-	116
Others	<u>192</u>	<u>1,029</u>	<u>1,905</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>3,126</u>
Total number of boats	<u>192</u> ===	<u>1,029</u> =====	<u>5,031</u> =====	<u>571</u> ===	<u>667</u> ===	<u>182</u> ===	<u>7,672</u> =====

TABLE 5

Number of fishing boats by type and length

	<u>Length (m)</u>				<u>Total number of boats</u>
	<u>1-4.9</u>	<u>5-9.9</u>	<u>10-19.9</u>	<u>20 +</u>	
Trawlers	-	-	141	5	146
Purse seiners	-	222	568	236	1,026
Longliners-)	-	3,241	17	-	3,258
Gillnetters)	-	93	23	-	116
Beach seiners	-	205	-	-	3,126
Others	205	2,921	-	-	3,126
Total	205	6,477	749	241	7,672
	====	=====	====	====	=====

TABLE 6

Number of fishing boats by tonnage

	<u>tonnage class (m't)</u>						<u>Total number of boats</u>
	<u>0-0.5</u>	<u>0.5-1.0</u>	<u>1.0-5.0</u>	<u>5.0-10.0</u>	<u>10.0-50.0</u>	<u>50.0+</u>	
Aegean	126	240	808	115	50	3	1,342
Mediterranean	-	33	782	19	43	10	887
Total number of)	192	1,029	5,031	571	667	182	7,672
boats in Turkey)	====	=====	=====	====	====	====	=====

TABLE 7

Number of fishing boats
by horse power

	<u>Horse power (HP)</u>					<u>Without engine</u>	<u>Total number of boats</u>
	<u>1-9</u>	<u>10-19</u>	<u>20-49</u>	<u>50-99</u>	<u>100</u>		
Aegean	707	241	134	71	39	150	1,342
Mediterranean	541	241	32	13	59	1	887
Total number)	3,732	2,082	531	333	674	320	7,672
of boats in)							
Turkey)							

TABLE 8

Number of fishing boats by length

	<u>length (m)</u>				<u>Total number of boats</u>
	<u>1-4.9</u>	<u>5-9.9</u>	<u>10-19.9</u>	<u>20 +</u>	
Aegean	91	1,172	72	7	1,342
Mediterranean	11	795	69	12	887
Total number) of boats) in Turkey)	205	6,477	749	241	7,672

TABLE 9

Number of fishing boats
by number of crew

							<u>Total number of fishing boats</u>	<u>Fishing boats without hired crew</u>
	<u>1-4</u>	<u>5-9</u>	<u>10-19</u>	<u>20-29</u>	<u>30 +</u>	<u>Total</u>		
Aegean	504	19	29	-	1	553	1,342	789
Mediterranean	561	6	5	-	1	573	887	314
Total number) of boats) in Turkey)	1,749	197	177	49	37	3,209	7,672	4,463

2.3 Fishing output

As it is clear from Table 10, during the planning period from 1960 to 1982 outputs have increased steadily.

TABLE 10

Year	<u>Total Turkish production</u>					<u>Percentage of total Turkish production</u>	
	<u>Inland</u>		<u>Marine</u>		<u>Total</u>	<u>Aegean</u>	<u>Mediterranean</u>
	<u>Amount</u>	<u>%</u>	<u>Amount</u>	<u>%</u>			
1952	6,016	7.12	78,497	92.88	84,503		
1953	5,413	3.21	163,323	96.79	168,736		
1960	7,149	8.16	80,412	91.84	87,561		
1962	7,007	5.92	111,393	94.08	118,400		
1963	7,043	5.45	122,264	94.55	129,307		
1965	6,383	4.78	126,995	95.22	133,378		
1967	6,378	3.86	158,922	96.14	165,300		
1969	11,115	6.64	156,237	93.35	167,352	2.17	2.76
1970	13,249	7.40	166,080	82.60	179,186	2.58	2.00
1971	14,442	9.02	145,744	90.98	160,186	1.93	2.20
1972	16,849	8.30	186,151	91.70	203,000	1.34	1.77
1973	15,618	5.61	263,000	94.39	278,618	1.29	1.78
1974	13,926	5.74	228,857	94.26	242,783	1.49	2.57
1975	18,472	7.63	223,628	92.37	242,100	3.48	2.96
1976	18,895	7.10	247,105	92.90	266,000	4.68	2.44
1977	18,320	6.54	261,685	93.46	294,000	4.12	2.88
1978	21,806	8.86	224,227	91.14	246,033	5.74	4.43
1979	23,214	6.59	329,268	93.41	352,482	5.54	2.31
1980	33,229	7.72	397,321	92.28	430,541	4.63	2.01
1981	32,658	6.92	439,206	93.08	471,864	4.31	3.03
1982	33,616	6.67	470,171	93.33	503,787	3.26	2.46
Average		6.60		93.40		3.34	2.75

2.4 The Turkish Fishery within the Mediterranean Context

Turkey's fishing areas with their distinctive characteristics are the Black Sea in the north, the Marmara Sea and the straits and the Aegean Sea in the west, and the Lavantine basin of the Mediterranean in the south.

This belt is 8,333 km long and covers a marine area of approximately 154,080 m². The Aegean and Mediterranean coastlines of Turkey especially are comparatively richer than the coastlines of other Mediterranean countries.

2.5 Fishing Output in 1983

The figures for 1983 issued by the State Statistical Institute are presented in Table 11.

2.6 Marine Sponges

The Bodrum Sponge Research Center has made studies on sponge stocks in 1982 and 1983. The "quadrant" method of evaluation of stocks has established the existence of a total of 21 t of sponge in two bays. It is planned to extend this research from the northern part of the Aegean down to Iskenderun Bay in the Mediterranean from 1986 onwards. Total sponge output of Turkey in 1983 was approximately 20 t.

2.7 Fish Farming

The Aegean coastline of Turkey is very suitable for marine fish farming: there are plenty of bays well protected from prevailing winds and waves and no pollution in these regions. Most of the species which are currently cultured in this sector naturally inhabit these waters. A modern hatchery has recently been set up in the Aegean region to grow sea-bass, sea-bream and shrimps from eggs. About 20 private enterprises have applied for investment in this sector during 1985.

It is possible to catch plenty of larvae during spring and to put them to grow, especially in Aegean coastline and lagoons. Three establishments started production by this method during 1985.

3. CONSUMPTION OF FISHERY PRODUCTS IN TURKEY

The State Statistical Institute provided data for 1983 (see Table 12), showing national consumption of fish products through various marketing channels by region.

Table 13 shows the percentage distribution of fish products by marketing channels and regions.

Between 1970 and 1979, 97.5% of fishery output has gone into domestic consumption and 2.5% into export.

When compared to total world output, the Turkish fishing industry is inadequately developed, output needs to be balanced and exports have not increased in proportion to the increase in output. Exports totalled 8,420 t in 1972, 5,368 t in 1976, 7,500 t in 1980 and 11,310 t in 1981. A considerable portion of our exports are made of species with lump-meat and crayfish and snails from our inland waters (Table 14).

TABLE 11

Catch amount of sea fish, spawning seasons and catching methods

Types of fish	Latin name	Catches (tons)			Spawning seasons	Catching methods
		Aegean	Mediterranean	Total		
Lear fish	<i>Lichia amina</i>	140	670	824	April-August	Handline - Beach seine
AVCI ¹ /	<i>Seriola dumerilii</i>	-	58	86	-	-
Whiting	<i>Gadus merlangus</i>	114	70	382	November-May	Handline - Beach seine
Striped mullet	<i>Mullus barbatus</i>	659	1.010	3 669	May-July	Bottom trawl - Beach seine - Bottom-set gillnets
Gilt-head bream	<i>Sparus aurata</i>	284	471	769	December-February	Stationary fishtraps - Bottom-set gillnets - Handline
Sole-Flounder	<i>Solea</i> sp.	172	126	588	December-March	Bottom trawl - Bottom-set gillnets
John Dory	<i>Zeus faber</i>	8	12	20	May-July	Trawl - Beach seine
Common sea bream	<i>Pagrus pagrus</i>	63	95	162	April-August	Bottom-set longlines
Bearded rockling	<i>Gaidropserus mediterraneus</i>	3	3	60	Autumn	Pots
GRENYÜZ ¹ /		29	27	66	-	-

Table 11 (cont'd)

Types of fish	Latin name	Catches (tons)			Spawning seasons	Catching methods
		Aegean	Mediter- ranean	Total		
Sand smelts	<i>Atherina boyeri</i>	3	274	347	April-August	Liftnets - Beach seine
European anchovy	<i>Engraulis encraticolus</i>	892	-	300 372	April-July	Purse seine - Beach seine
Cabrilla-Seabass	<i>Serranus sp.</i>	10	43	53	April-July	Bottom-set longlines - Beach seine - Gillnets
Barracuda	<i>Sphyraena sp.</i>	2	2 345	2 350	April-July	Gillnets
Scorpin fish	<i>Scorpaena scorpa</i>	149	23	405	May-September	Trawl - Beach seine
Annular bream	<i>Diplodus annularis</i>	233	79	583	May-September	Purse seine - Beach seine - Handlines
Horse mackerel	<i>Trachurus sp.</i>	1 109	209	63 498	June-August	Purse seine
Brown meagre	<i>Sciaena umbra</i>	3	7	45	May-August	Gillnets - Handlines
Pickarel	<i>Maena sp.</i>	516	517	2 983	April-June	Beach seine - Handlines

Table 11 (cont'd)

Types of fish	Latin name	Catches (tons)			Spawning seasons	Catching methods
		Agean	Mediterranean	Total		
Atlantic horse Mackerel	<i>Trachurus trachurus</i>	241	180	9 775	June-August	Purse seine
Turbot-Brill	<i>Scophthalmus</i> sp.	3	-	5 398	April-June	Trawl - Bottom-set gillnets
White sea bream	<i>Diplodus sargus</i>	202	200	570	April-August	Stationary fish traps - Bottom-set gillnets
Goby	<i>Gobius</i> sp.	79	1 470	1 554	Spring-Summer	Bottom-set gillnets - Handlines
Mulletts	<i>Mugil</i> sp.	1 284	1063	5 790	Spring-Autumn	Beach seine - Purse seine - Stationary fish traps
Angelshark	<i>Squatina squatina</i>	2	5	7	Summer	Gillnets
Sword Fish	<i>Xiphias gladius</i>	80	5	216	April-September	Drift gillnets - Pelagic longlines
Gurnard	<i>Tripla</i> sp.	8	34	343	Summer	Trawl - Beach seine - Gillnets
Chup mackerel	<i>Scomber japonicus</i>	602	511	4 055	Spring	Beach seine - Purse seine
Smoothound	- <i>Mustelus mustelus</i> - <i>Squalus acanthias</i>	35	357	7 822	Spring-Summer	Trawl - Longlines

Table 11 (cont'd)

Types of fish	Latin name	Catches (tons)			Spawning seasons	Catching methods
		Aegean	Mediterranean	Total		
Bogue	<i>Boops boops</i>	588	156	849	April-August	Handline - Trawl - Purse seine
European seabass	<i>Dicentrarchus labrax</i>	665	321	1 007	February-April	Beach seine - Purse seine - Gillnets - Stationary fish traps
Black Scorpion Fish	<i>Scorpaena porcus</i>	1	-	14	August	Bottom-set gillnets
Blue fish	<i>Pomatomus saltatrix</i>	573	616	30 854	April-June	Purse seine - Beach seine - Handlines
Saddled bream	<i>Oblado melanura</i>	56	106	176	Spring-Summer	Trawl - Beach seine - Handline - Bottom-set gillnets
Common pandora	<i>Pagellus</i> sp.	305	300	614	Spring-Summer	Bottom-set - Longlines
Poutassou	<i>Gadus poutassou</i>	2	82	12 649	March	Trawl - Handlines
Wormxeel	<i>Pagellus mormyrus</i>	63	69	161	April-October	Longlines - Gillnets
Cord	<i>Umbrina cirrosa</i>	19	76	553	May-August	Gillnets - Handlines
Dusky grouper	<i>Epinephelus gigas</i>	57	142	202	Spring-Summer	Bottom-set - Longlines - Underwater guns

Table 11 (cont'd)

Types of fish	Latin name	Catches (tons)			Total	Spawning seasons	Catching methods
		Aegean	Mediterranean				
Bluefin tuna	<i>Thunnus thynnus</i>	31	382		557	July-August	Purse seine
Atlantic bonito	<i>Sarda sarda</i>	635	121		29 034	March-August	Purse seine
Sardine	<i>Sardinella</i> sp.	6 376	1 154		11 241	Spring-Summer	Purse seine - Beach seine
Meagre	<i>Sciaena aquila</i>	6	151		158	May-August	Gillnets - Stationary fish traps
Black sea bream	<i>Cantharus lineatus</i>	11	16		31	April-August	Bottom-set gillnets
Gold line	<i>Boops salpa</i>	113	24		157	April-August	Stationary fish traps - Bottom-set gillnets - Handlines
Dogs-teeth	<i>Dentex dentex</i>	99	36		136	April-August	Bottom-set - Longlines
Surmullet	<i>Mullus surmuletus</i>	90	94		2 699	May-July	Bottom-set gillnets - Bottom trawl - Beach seine
Shad	<i>Alosa fallax nilotica</i>	79	140		614	Spring	Handline - Gillnets - Purse seine

Table 11 (Concluded)

Types of fish	Latin name	Catches (tons)			Spawning seasons	Catching methods
		Aegean	Mediterranean	Total		
Goldney	<i>Pagrus ehrenbergii</i>	71	27	662	Spring-Summer	Bottom-set gillnets - Bottom-set longlines
Large bonito	<i>Sarda sarda</i>	60	63	451	Spring-Summer	Purse seine
Barracuda	<i>Sphyræna barracuda</i>	25	147	195	April-July	Gillnets
Mackerel	<i>Scomber scomber</i>	154	14	445	March-August	Purse seine
Skate	<i>Raja</i> sp.	6	208	3 344	Spring-Summer	Trawl - Bottom-set gillnets
Garfish	<i>Belone belone</i>	51	26	758	April-June	Purse seine - Beach seine
Skippy	<i>Scomberesox saurus</i>	2	17	19	April-September	By chance
Others		-	411	1 194		
Total		17 063	14 763	511 526		

1/ Local sea product, English equivalent is unknown.
Fish which are not produced are excluded

TABLE 12

Distribution of fish products by marketing type and regions

Regions	Total production	Total of sales	Fish meal and oil factories	Cooperatives and associations	Commission agents dealers tradesmen	Canning factories	Consumers	Self-consumption	Others
Total	518,593	487,369	152,571	16,332	282,371	17,068	19,027	5,599	25,625
Aegean	19,057	17,787	-	4,393	7,281	459	5,654	473	797
Mediterranean	16,126	14,696	-	4,816	8,086	57	1,737	451	979

TABLE 13

Percent distribution of fish products by marketing type and regions

Regions	Total production	Total of sales	Fish meal and oil factories	Cooperatives and associations	Commission agents dealers tradesmen	Canning factories	Consumers	Self-consumption	Others
Total	100	93.98	31.31	3.35	57.94	3.50	3.90	1.08	4.94
Aegean	100	93.34	-	24.70	40.93	2.58	31.79	2.48	4.18
Mediterranean	100	91.13	-	32.77	55.02	0.39	11.82	2.80	6.07

TABLE 14

Fishery products exports (1967-81)
(quantities in t; amount in million TL)

	1967		1973		1978		1980		1981	
	Amount	Value	Amount	Value	Amount	Value	Amount	Value	Amount	Value
I. UNPROCESSED										
Freshwater fish	0.60	0.002	757.76	0.087	197.62	12.560	613.15	108.172	543.44	98.335
Sea fish	6,399.78	25.114	5,863.89	33.364	1,259.59	44.976	2,151.99	279.190	7,107.96	1,074.113
Crustaceans (crayfish, shrimps, etc.)	511.10	3.690	1,533.72	43.187	2,402.69	161.557	2,369.73	581.767	2,414.84	694.819
Others	1,036.50	5.785	1,212.63	19.621	1,608.26	148.861	1,401.51	476.323	1,244.10	791.364
Total	7,947.98	34.591	9,368.00	105.259	5,468.16	367.954	6,536.38	1,445.452	11,310.24	2,658.631
	71.01	56.48	80.97	73.23	65.15	52.48	60.80	46.18	69.28	46.76
II. PROCESSED										
Freshwater fish	-	-	0.45	0.033	-	-	-	-	-	-
Sea fish	0.50	3.762	83.56	1.034	-	-	-	-	7.00	2.267
Crustaceans (crayfish, shrimps, etc.)	14.49	0.146	1,186.37	32.052	1,257.18	95.835	3,154.34	1,287.683	4,102.24	2,627.041
Snails	2,724.72	22.704	44.76	1.926	1,637.44	237.109	964.59	377.394	897.85	396.043
Others	504.87	0.045	886.45	3.427	30.00	0.277	96.00	19.853	8.60	2.049
Total	3,244.38	26.657	2,301.59	38.472	2,924.62	333.221	4,214.93	1,684.930	5,015.69	3,027.400
	28.99	43.52	19.03	26.77	34.85	47.52	39.20	53.82	30.72	53.24
GRAND TOTAL	11,192.36	61.248	11,569.59	143.731	8,392.78	701.175	10,751.31	3,130.382	16,325.93	5,686.031

4. DEVELOPMENT OF THE FISHERY SECTOR DURING THE PLANNING PERIOD

Development of the fishery sector in Turkey began with the start of the planning period in 1963. During the first five-year period (1963-67), output was targeted at 12.5% for a sector with an insufficient infrastructural base. An output increase of 6.9% has been achieved. The actual figures also lagged behind the target figures during the second five-year planning period (1968-72). During this period, Law No. 1380 was enacted and resulted, together with an incensed organizational back-up, in a faster development.

TABLE 15

Developments in the fishery sector during the planning periods

<u>Planning periods</u>	<u>Yearly increasing percentage (%)</u>	
	<u>Goal</u>	<u>Reality</u>
I. <u>1963-67</u>		
(a) Production	12.5	6.9
(b) Export	9.6	6.6
(c) Internal Demand	10.8	9.2
II. <u>1968-72</u>		
(a) Production	9.1	4.2
(b) Export	17.6	18.3
(c) Internal Demand	7.6	6.5
III. <u>1973-77</u>		
(a) Production	8.4	7.4
(b) Export	9.5	2.9
(c) Internal Demand	8.4	7.7
IV. <u>1979-83</u>		
(a) Production	7.7	17.6
(b) Export	14.2	14.3
(c) Internal Demand	7.7	17.6

5. FISHERY EDUCATION AND RESEARCH ACTIVITIES IN TURKEY

Fishery studies in our country are fairly recent compared to developed fishing nations of the world. The first serious fishery educational and research activities started in the Hydrobiology Research Institute of the Faculty of the University of Istanbul during 1952. This institute has accomplished and contributed valuable results during the directorate of Prof. C. Kosswig. Later, a Fisheries Research Center was established at Besiktas Cold Storage depots of the General

TABLE 16

Fishery sector targeted for years 1984-93

Amount: 1,000 t; Value: Million TL. 1982 (June) Value

	<u>1984</u>		<u>1985</u>		<u>1986</u>		<u>1987</u>		<u>1988</u>		<u>1993</u>	
	<u>Amount</u>	<u>Value</u>	<u>Amount</u>	<u>Value</u>	<u>Amount</u>	<u>Value</u>	<u>Amount</u>	<u>Value</u>	<u>Amount</u>	<u>Value</u>	<u>Amount</u>	<u>Value</u>
Production	587.6	38194	632.9	41139	681.6	44304	734.1	47717	790.6	51389	1145.6	74464
Export	17.3	6495	20.0	7510	23.0	8637	26.6	9988	30.7	11528	62.8	23581
Internal demand	570.3	37070	612.9	39839	658.6	42809	707.5	45988	756.9	49394	1082.8	70382
Kg/head	11.6	-	12.2	-	12.8	-	13.5	-	14.2	-	18.5	-
Population (Millions)	49.025	-	50.142	-	51.284	-	52.451	-	53.643	-	59.987	-

Directorate of Meat and Fishery Products. This Directorate first started employing research boats for systematic marine research on physical, chemical and biological properties of waters down to 200 m deep. In Iskenderun, Trabzon and Canakkale, research stations have been established. The data obtained in these researches have been published in Hydrobiology series (A) and (B) and The Fish and Fishing Magazine. During the years between 1952 and 1971, sea research has been jointly carried out by the Navigation, Hydrography and Oceanography Department of the Turkish Navy Command, the Hydrobiology Research Institute of Istanbul University, and the Directorate of Meat and Fishery Products, Fishery Research Center. During this period, multi-purpose research programmes have been developed and implemented with the cooperation of FAO. In 1971, the Fishery Law No. 1380 was enacted, and the duties relating to fishery production assigned to the Ministry of Agriculture, Forestry and Rural Affairs. The General Fishery Directorate has been established inside the organizational structure of said Ministry.

The list of universities and Academies which provide education in fisheries is given below.

- Icel-Erdemli Sea Sciences Institute of the Middle East Technical University - Ankara,
- The Institute of Sea Sciences and Geography - Istanbul University,
- Academy of Fishery Products - Istanbul University,
- Academy of Fishery Products - Ege University - Izmir,
- The Institute of Sea Sciences and Technology - Dokuz Eylul University,
- The Academy of Naval Management - Dokuz Eylul University,
- The Academy of Egridir Fishery Products - Akdeniz University,
- The Academy of Fishery Products - Cukurova University,
- The Academy of Sinop Fishery Products - Ondokuz Mayis University,
- The Academy of Surmene Sea Sciences and Technology - Karadeniz University,
- The Academy of Fishery Products - Firat University,
- Fishery Department, Faculty of Agriculture - Ankara University,
- Hydrobiology Research Center of the Faculty of Sciences - Ege University,
- The Beykoz Fishery Professions High School of the Ministry of Education, Youth and Sports - Istanbul.

Three hundred publications have been issued between 1952 and 1962 on sea research. Of these publications, around 80% are issued in Turkish, 2% have been translated and 18% are issued in foreign languages. Since 1965 Turkish publications increased and since 1977 foreign publications increased in number.

5.1 Manpower in Education and Research

There are 125 instructors actively working in fisheries in Turkey.

TABLE 17

Manpower actively working in universities
and professional organizations of fisheries

<u>Title</u>	<u>Universities</u>	<u>Professional organizations</u>
Professors	18	-
Doctors of Philosophy	21	2
Doctors	26	13
Researchers	<u>60</u>	<u>50</u>
TOTAL	<u>125</u> =====	<u>65</u> ===

Professional organizations employ 65 special advisers. It is clear that 100 to 125 instructors for 16 schools offering education in fisheries is not sufficient.

5.2 Laboratories, Tools and Equipment

There are 46 laboratories taking active or indirect part in the fisheries sector and 50 ships and boats being used for fishery research (Table 18).

TABLE 18

Boats used in the fishery research

<u>Description</u>	<u>Number</u>
Boats with engine and without	40
Boats with LOA 12-15 m	4
Boats with LOA 15-22 m	3
Boats over 22 m and ships	<u>3</u>
TOTAL	<u>50</u> ===

ANNEX(E) H

Pre-war long-term changes in the abundance of *Pagellus erythrinus*
Merluccius merluccius and *Engraulis encrasicolus*
in Greek waters and climatic change

by

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1. INTRODUCTION

Long-term changes in the abundance of marine fish have been reported from various areas of the world ocean and have been linked to hydrometeorological fluctuations (Hjort, 1914; Jensen, 1939; Taylor et al., 1957; Cushing and Dickson, 1976; Stergiou, 1984). No such information is available for the eastern Mediterranean Sea.

In the present work, which is part of a literature review pertinent to marine climatic changes and their biological repercussions in the Mediterranean Sea undertaken by the author, information with regard to the pre-war fluctuations in the red pandora (*Pagellus erythrinus*), hake (*Merluccius merluccius*) and anchovy (*Engraulis encrasicolus*) catches in Greek waters is presented. In addition, the relationship between the changes in the abundance of these species and air temperature at Thessaloniki, northern Greece, is determined, and hypotheses governing the long-term trends of the catches are discussed.

2. MATERIAL AND METHODS

Pre-war catches of red pandora, hake and anchovy in Greek waters, as well as the number of trawlers and purse seiners, have been recorded on a monthly basis for the 1928-39 period (Greek Fisheries Statistics, 1934-40). Annual catches of hake and red pandora were expressed as kg/trawler, whereas those of anchovy as kg/purse seiner. There is not any information with regard to the fishing effort (kg/hr) during that period. The fact, however, that red pandora, hake and anchovy were of local importance, without entering the export market, and the low efficiency of the equipment used then, as compared with the contemporary one, may imply that the fishing of these species was not of commercial effort standard.

Unfortunately, there are not any data concerning sea temperature fluctuations in Greek waters during the same period. Nevertheless, it has been repeatedly shown that there is a reasonably good agreement between the air and sea-surface

temperature fluctuations (e.g. Taylor *et al.*, 1957; Dunbar, 1982; Stergiou, 1984). Monthly observations of the air temperature have been maintained since 1892 at Thessaloniki, northern Greece, consolidated by Flocas and Papadimitriou (1974). Hence, the long-term trends of the air temperature at Thessaloniki will be used to describe long-term temperature variations in Greek waters.

3. RESULTS

The catches of the three species and the number of trawlers and seiners for 1928-39 are tabulated in Table 1. The mean annual yield of hake, red pandora and anchovy in that period numbered 416, 268 and 510 t respectively.

Long-term changes in the abundance of red pandora, hake and anchovy, expressed as kg/boat and air temperature at Thessaloniki show essentially a similar pattern (Fig. 1). There is an increase to a peak around 1930-31, followed by a drop to a trough in the mid-1930s and an upward trend to a maximum in the late 1930s. Maxima and minima of the air temperature, however, are manifested earlier than those of the catches. The similarity is even more pronounced when the 5-year moving averages are taken, and hence the short-term is masked. The long-term increase in the landings from a low in the late 1920s to a peak in the mid-1930s parallels the upturn trend of the air temperature (Fig. 2). The increase in the catches of anchovy is sharper than that of red pandora and hake.

Hake annual catches were not found to be significantly correlated with the annual air temperature, whereas highly significant, positive correlations were found between the annual air temperature and the annual catches of red pandora ($r=0.69$, $p<0.01$) and anchovy ($r=0.65$, $p<0.01$). When the 5-year moving averages were taken, highly significant, positive correlations were found between the red pandora, hake and anchovy catches and the air temperature (Table 2).

4. DISCUSSION

As it is shown from Figures 1 and 2 and Table 1, an increase of the red pandora, hake and anchovy yield in Greek waters is related to a rise of the water temperature, as it is inferred from that of the air. Indeed, sea temperature variations are considered to be a primary cause of fluctuations in the bottom and pelagic fisheries (e.g. Jensen, 1939; Taylor *et al.*, 1957; Dickson and Cushing, 1976; Stergiou, 1984). Undoubtedly, water temperature directly influences the formation of fishery resources in the sea. An increase of water temperature hastens growth and egg and larvae development, intensifies the process of albumen metabolism and influences the amount of the available food for fish.

Sea temperature change, however, is only one consequence of marine climatic changes, which involve changes in the salinity, intensity and direction of currents, nutrients, depth of mixed layer, ice extent, and duration of ice season as well. In addition, marine climatic changes are closely associated with atmospheric climatic changes. The biological responses to climatic changes involve changes in the amplitude, spread and timing of production, as well as changes in the distribution, abundance and reproduction of the various planktonic, benthic and nektonic organisms. For instance, Stergiou (1984) showed that during periods of an increased North Cape current intensity (S, SW winds: high sea temperature) the productivity of the Barents Sea decreases, the Barents Sea capelin (Mallotus villosus) stock occupies the eastern part of the Sea, spawning grounds are displayed to the east and weak year-classes of capelin are produced. The pattern is reversed in years characterized by a decreased North Cape current intensity (N, NE and E winds, low sea temperature).

Other aspects of climatic change that may influence the abundance of hake, red pandora and anchovy in Greek waters must be questioned. For instance, does the degree of matching of the distribution of anchovy, hake and red pandora larvae and that of their food ("match-mismatch" hypothesis, Fig. 3) change along with a change in the Mediterranean climate? Or, does the amount of nutrients and plankton biomass in the eastern Mediterranean Sea change along with a change in the climate, and how? A functional relationship between primary production and anchovy population time series has been shown in the southern California Bight (Smith and Eppley, 1982). Yet, does the extent of the nursery area of these species change along with a change in the current intensity and direction, if any, and how? Or, is there any predator-prey relationship among hake, red pandora and anchovy and other fish of the eastern Mediterranean ecosystem underlying these changes?

In any case, there is no doubt that the causal relationships underlying any interactions between changes of the atmospheric and marine climate, and those of the abundance of hake, red pandora and anchovy, must be very complex, involving all sort of behavioural, physiological and even genetic responses. The various pieces of evidence hitherto presented do, however, provide cumulative support that climatic change holds a key to the abundance of these fish in Greek waters.

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Table 1

Annual catches, in metric tonnes, of hake, red pandora and anchovy in Greek waters, and total number of trawlers and seiners, 1928-1939.

Year	Hake	Red Pandora	Ancovy	Boats
1928	125.5	89.4	46.1	449
1929	317.1	159.4	178.8	696
1930	427.1	227.8	147.7	555
1931	443.9	323.9	318.7	638
1932	376.3	297.3	82.4	665
1933	436.3	244.3	131.8	543
1934	463.3	315.4	532.2	518
1935	472.1	315.6	252.1	500
1936	396.8	395.4	441.8	627
1937	444.8	412.5	1163.7	611
1938	917.2	406.1	1213.4	665
1939	633.6	364.5	1618.1	582
Total	4990.7	3551.6	6126.6	
Mean	415.9	268.1	510.6	579

Table 2

Pearson Correlation Coefficients Between the 5-year Moving Averages of the Hake, Red Pandora and Anchovy Catches and the 5-year Moving Averages of the Air Temperature at Thessaloniki, 1928-1939. Numbers in Parentheses Show Number of Data points.

	Hake	Red Pandora	Anchovy
Air T	+0.90 p<0.01 (8)	+0.95 p<0.01 (8)	+0.95 p<0.01 (8)

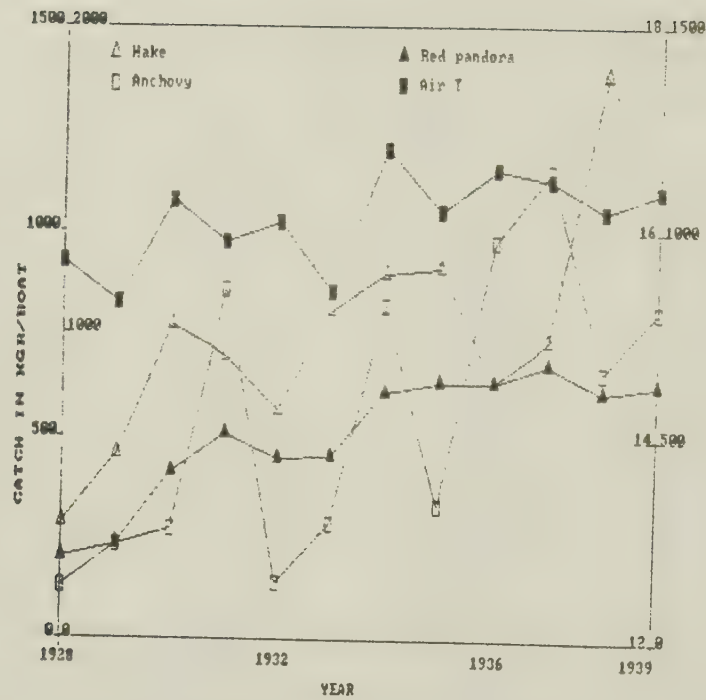


Figure 1. Annual Greek catches, in kg/boat, of hake, red pandora and anchovy and annual air temperature at Thessaloniki, northern Greece, 1928-39

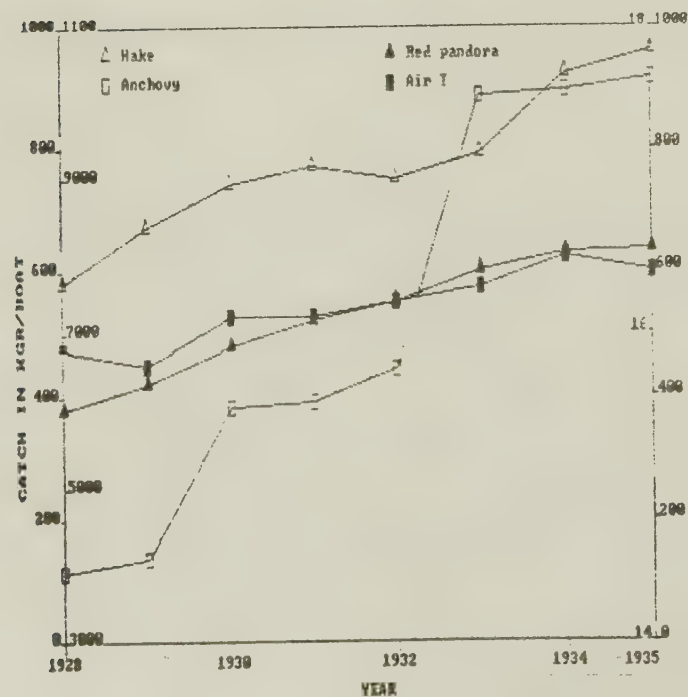


Figure 2. Five-year moving averages of the annual catches, in kg/boat, of hake, red pandora and anchovy in Greek waters and five-year moving averages of air temperature at Thessaloniki, northern Greece, 1928-39

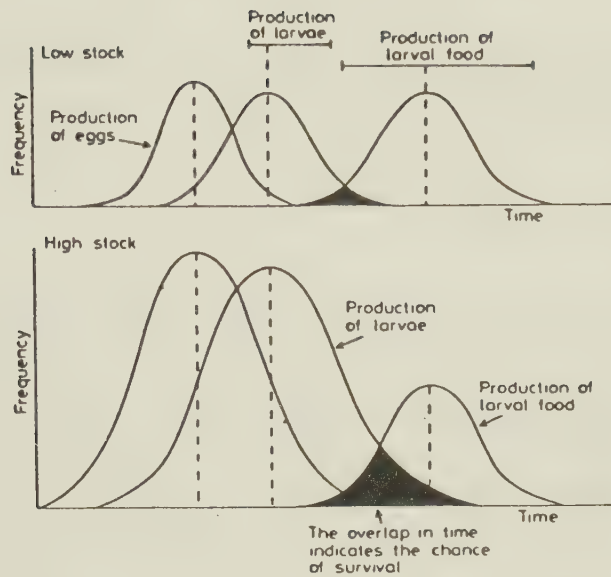


Figure 3. Match-mismatch hypothesis. The production cycle varies in time, amplitude and spread. The distribution of fish larvae and of their food may overlap and the degree of matching determines the success of the year-class. At high stock conditions (lower), the overlap between the production of larvae and of their food is greater or the chance of match is improved (from Cushing, 1981).

ANNEX(E) I

Preliminary biological data on the red pandora
(Pagellus erythrinus L., 1758) in the Greek seas

by

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I. INTRODUCTION

The red pandora is a common fish of sublittoral zones and the greatest depth that it was found in was about 130 m.

The present study provides information concerning length composition, growth in length and age and mortality of red pandora in the Saronikos Gulf and in the Ionian Sea as a contribution to a greater understanding of the population dynamics of the species.

2. MATERIAL AND METHODS

The following data come from samples of red pandora collected during seasonal fishing cruises in the Saronikos Gulf from September 1975 till December 1976, and in the Ionian Sea from June 1983 till June 1985. All surveys were carried out by a commercial 425 HP trawler within the framework of fisheries investigations conducted by NCMR.

Age was determined by scale reading. Scales were cleaned in 5% sodium peroxide and their impressions were made by placing several scales from each fish on a strip of 0.25 inch-thick cellulose acetate and applying pressure of 8 t/in² and 80°C on a CARVER auto-press.

3. COMPOSITION BY LENGTH AND AGE

The length frequency composition of red pandora was based on observed length from 709 and 1140 specimens caught in the Saronikos Gulf and in the Ionian Sea respectively (Figure 1). The higher proportion of these specimens falls in the length range 110-150 mm (ages I, II, III) for Saronikos and 100-160 mm (ages I, II, III) for the Ionian Sea. In the length range of 190-250 mm there are few fish; this is attributed to the higher expected total mortality for the older specimens.

By comparing the length frequency histograms of the two areas, it can be observed that in Saronikos Gulf there are few very young fish, while in the Ionian Sea they appear in great numbers. The young of the year appear as recruits in the Saronikos Gulf in March and in the Ionian Sea in November.

These observations in combination with the fact that red pandora spawns in Saronikos in autumn and in the Ionian Sea in spring, leads us to the conclusion that we are dealing with two different populations. Papaconstantinou (1984), in his study of red pandora in the Saronikos, Pagassitikos and Thermaikos Gulfs and in the Thracian Sea, presumes that the populations of this species in the areas mentioned above are the same. Consequently, we can corroborate the view that there are two different populations of red pandora: one in the western and the other in the eastern marine waters of Greece.

4. GROWTH IN LENGTH

The relationships of fork length and scale radius obtained with 604 specimens from the Saronikos Gulf and 1017 specimens from the Ionian Sea were $L=34.27+0.295$ and $L=15.23+0.885$ respectively; where L =length in mm ($\times 40$). The correlation coefficients for the two equations were 0.95 and 0.96.

The analysis of co-variance indicated that a significant statistical difference exists in the body length-scale radius relationship between the individuals of the two areas: $F = 24.77$, $d.F. = 1618$; $P < 0.05$.

The estimation of annual growth increment was made using the back calculation method. The individuals during the first year of their life in the Saronikos Gulf attain 50.5% while in the Ionian Sea 45.5% of the maximum adult size. After the completion of the first year, the annual growth rate reduces rapidly and remains at values of 12.6-6.8% of the maximum length in the Saronikos Gulf (age groups I-VI) and of 12.8-4.2% in the Ionian Sea (age groups I-VIII, Tables 1 and 2).

5. GROWTH IN WEIGHT

The length-weight relationship $W=axL^b$, where W =total weight of fish in grams, L = fork length in mm and a, b are constants, was used for the estimation of growth in weight of the red pandora.

The regression that was computed by the least squares method, based on 709 and 1311 individuals from the Saronikos Gulf and the Ionian Sea, was:

$$W = 2.7 \times 10^{-5} \times L^{2.93024}, \quad r = 0.97, \quad \text{for the Saronikos Gulf}$$

$$W = 2.57 \times 10^{-5} \times L^{2.929887}, \quad r = 0.92, \quad \text{for the Ionian Sea.}$$

The analysis of co-variance showed a significant statistical difference in the length-weight relationship between the individuals of the two areas: $F = 16.24$, $d.F. = 2017$, $P < 0.05$; thus those from Saronikos were heavier for a given length than the ones from the Ionian Sea.

6. CONDITION FACTOR

The condition factor was estimated using the equation proposed by Hile (1936): $K = W \times 10^5 / L^3$

where W = total weight of fish in grams. This gave the results presented in Table 3.

The red pandora in Saronikos was more robust than that in the Ionian Sea.

7. MORTALITY

The total mortality rate was estimated following Pauly's method (1983). The total mortality coefficient z was calculated for the Saronikos Gulf and the Ionian Sea separately, and its values were $z = 0.78$ and $z = 0.94$ for the Saronikos Gulf and the Ionian Sea, respectively.

The natural mortality M was estimated according to Pauly's method (1983), based on the estimation of $L_{inf.}$, K and $\bar{T}$ (mean environmental temperature) and was found to be $M = 0.19$ for the Saronikos Gulf and $M = 0.15$ for the Ionian Sea.

An exploitation ratio E was also computed according to the formula: $E = F / (F + M)$. Its values were found to be rather high in both marine areas, $E = 0.76$ for the Saronikos Gulf, and $E = 0.84$ for the Ionian Sea, indicating that the red pandora stocks in the two areas are overfished.

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TABLE 1
Back calculated fork lengths (mm x 40) of red pandora
from the Saronikos Gulf (1975-76)

Ages	Calculated length at end of year:					
	I	II	III	IV	V	VI
Number of fish	202	162	86	58	12	8
Average length	109.2	136.5	162.2	183.9	201.6	216.3
Aver.an.increment	109.2	27.3	25.7	21.7	17.7	14.7
Annual increment %	50.5	12.6	11.9	10.1	8.1	6.8

TABLE 2
Back calculated fork lengths (mm x 40) of red pandora
from the Ionian Sea (1983-85)

Ages	Calculated length at end of year:							
	I	II	III	IV	V	VI	VII	VIII
Number of fish	1017	691	266	118	60	34	17	1
Average length	101.0	129.5	153.4	173.8	189.3	202.2	212.7	222.1
Aver.an.increment	101.0	28.5	23.9	20.4	15.5	12.9	10.6	9.3
Annual increment %	45.5	12.8	10.8	9.2	6.9	5.8	4.6	4.2

TABLE 3
Mean values of condition factor of red pandora per area, per season

AREA	SPRING	SUMMER	AUTUMN	WINTER
Saronikos Gulf	1.96	1.91	1.91	1.97
Ionian Sea	1.99	1.78	1.90	1.83

TABLE 4
Total mortality coefficient (z), fishing mortality (F),
natural mortality (M) and exploitation ratio (E) per area

AREA	z	M	F	E
Saronikos Gulf	0.78	0.19	0.59	0.76
Ionian Sea	0.94	0.15	0.79	0.84

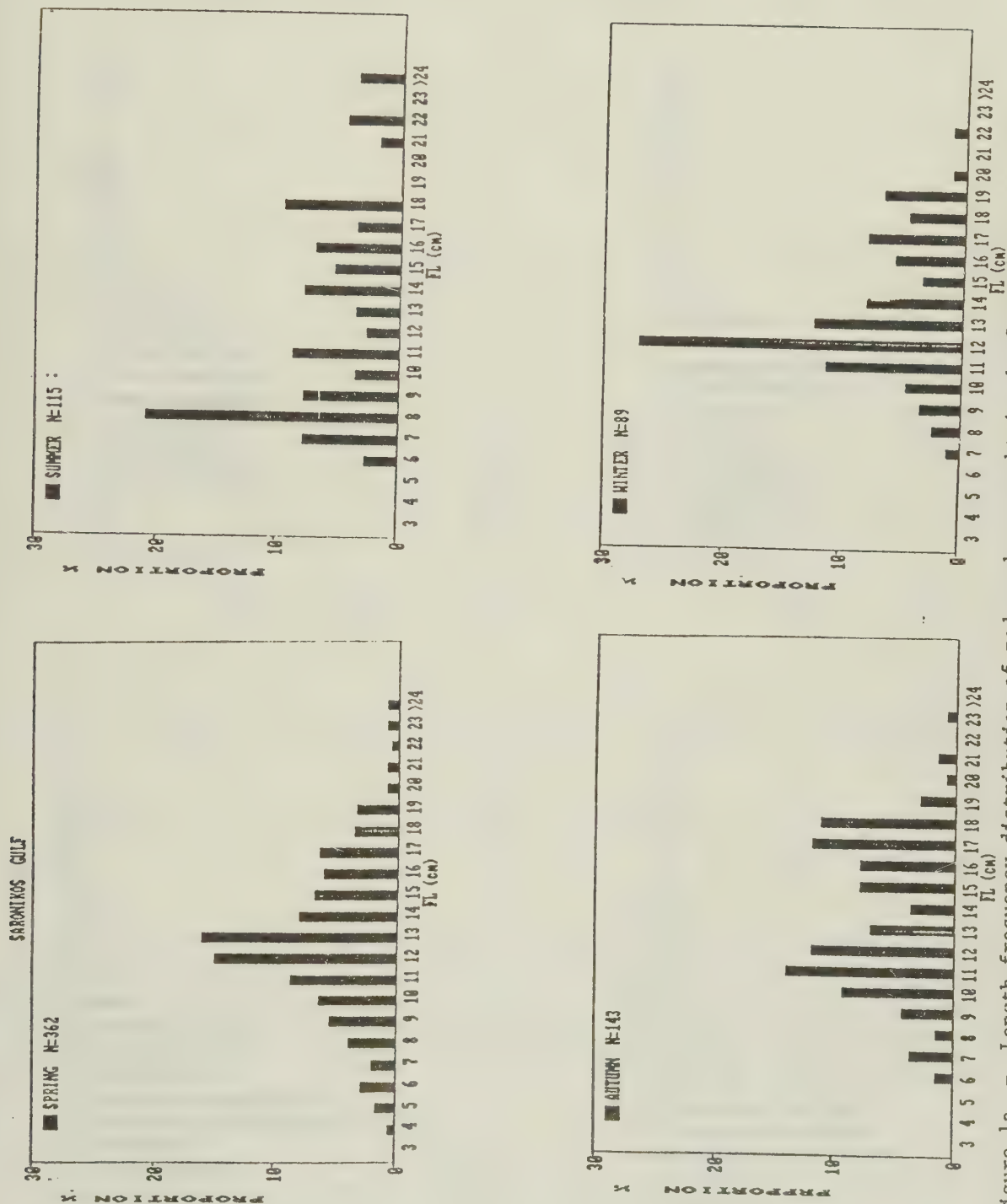


Figure 1a - Length frequency distribution of red pandora caught in the Saronikos Gulf from April to December 1976.

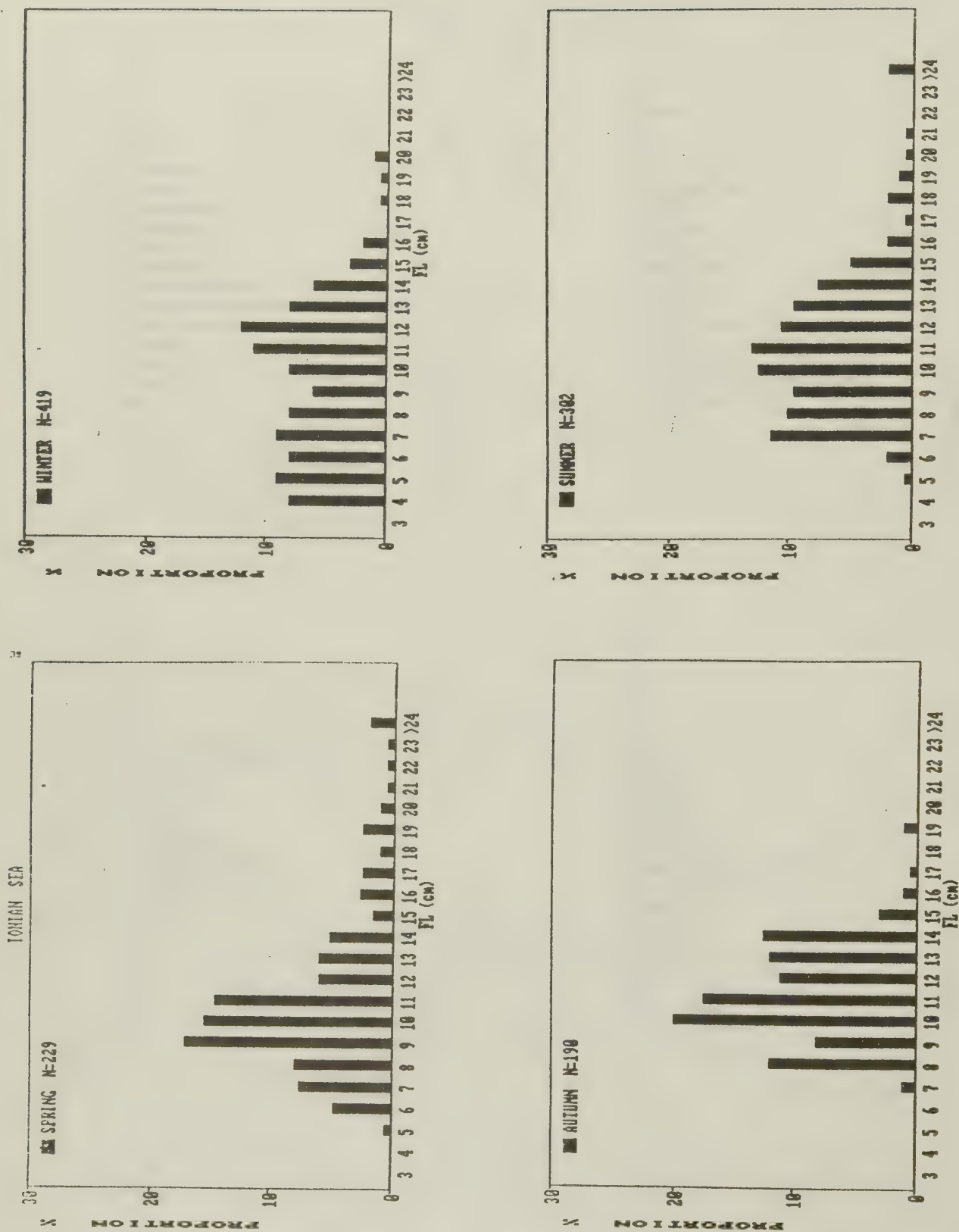


Figure 1b - Length frequency distribution of red pandora caught in the Ionian Sea from April to November 1984

ANNEX(E) J

Preliminary study on age, growth and reproduction of parrot fish,
Sparisoma cretense (L.), from Kastellorizo Island, Greece

by

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1. INTRODUCTION

The parrot fish, *Sparisoma cretense* (L., 1758) is distributed along the western Atlantic Ocean from Portugal to Senegal and the Eastern-Central Mediterranean shores, in depths ranging from shallow to about 50 m (Tortonese, 1975). Its biology is poorly known. Brief details on its spawning season and the description of the younger developing stages are given by Cipria (1939) and Sparta (1956). There are no published data on the age composition and rate of growth. The parrot fish presents a moderate commercial importance in Greece, especially in the area of the Dodecanesus, but the lack of knowledge of its biology hinders management. The purpose of the study was to secure information on the population dynamics of the species, including survival, growth, success of natural reproduction.

2. MATERIAL AND METHODS

Commercial trammel bottom net (3-panel, 500-800 m length, 1 m depth, with 40-18-40 mm mesh from knot to knot) were used to sample the parrot populations. Sampling was seasonal, from April to October during 1985.

Total length in mm, weight in grams, sex, maturity stages and scale samples were taken from parrot fish of all size groups. The age was determined by scale reading.

Scale samples were normally selected from the left side of the fish, midway between the insertion of the dorsal fin and the belly. Scale impressions were made in celluloseacetate strips and magnified 32 diameters by a microprojector. Diameters of scales and growth fields were measured to the nearest millimeter along a line passing through the focus and roughly bisecting the anterior field.

3. LENGTH-FREQUENCY DISTRIBUTIONS

A length-frequency distribution of 238 parrot fish from Castellorizo Island, based on the mean total length at capture, is illustrated in Figure 1, over the period April to October 1985. Both sexes were combined, since no differences were found in growth and length between males and females. The total length distribution ranged from 100 to 300 mm.

The length-frequency polygon of the April-June and October samples shows several modes, suggesting that the populations consisted mainly of three- and four-year classes respectively, with modes at approximately 140-150, 170-180, 200-210 and 230-240 mm. These ranges in length were presumed to represent age groups I, II, III and IV respectively. Age group I+ predominated numerically during June, with a mode length of 150-170 mm. This probably represented a movement of the population into the area. Figure 1 shows the fish of the age group 0+ were represented by a low number. This scarcity can be attributed to:

- (a) the selectivity of the trammel bottom nets used, whose meshes were too large to retain the smaller parrot fish,
- (b) dispersal of fish in different areas according to ecology, and
- (c) high mortality of the young fish born in 1984.

4. AGE AND GROWTH

We chose linear description of body-scale relationship. The coefficient of correlation, determination and the standard error estimates indicated that curvilinear relationships would not improve the selection. The analysis of covariance test, comparing the slopes of the regression lines for males and females, was not significant at the 0.05 level (F 1.72 d.f. 202).

The equation expressing the total length-scale radius for the April-October 1985 sample of 214 parrot fish is:

$$Y = 37.6 + 0.7X$$

where Y is total length in mm and X is scale radius in micrometric units ($X \geq 32$).

The average growth in length was rapid during the first growing season. Increments of growth declined after age I and became nearly constant between ages III and IX. The growth comparison broke down after the 6th year, because the few older fish grew more slowly and thus gave small growth increments. Major growth (43%) occurred during the first year of life. In the following four years, the fish increased 40.0 to 20.0 mm per year or 13.6-7.0% of the calculated total length attained at age IX. In conclusion, the parrot fish in the Castellorizo area is a slow-growing fish, with a moderate longevity. The oldest male and female specimens were 9 and 8 years old respectively. There are no indications of Rosa Lee's phenomenon, in which computed lengths at a given age tend to be smaller when derived from measurements on older fish.

The systematic decline in calculated growth rate with increase in age is something common among the trammel bottom set catches. Most investigators agree that the decline in calculated lengths can be traced to two major sources of bias:

(1) gear selection of the larger fish in the younger age groups, and (2) the progressive selection of the faster-growing fish by the fishery. The selection action of the gear is most pronounced on fish captured in gillnets of a single mesh size. Only fish of a definite size range are vulnerable to a specific mesh size, leaving free those individuals which are either too large or small to become entangled in the net. Gillnets of graded mesh sizes, such as the trammel bottom nets used in this study, greatly reduce bias through gear selection, because fish of a much greater size range are vulnerable to the gear. Gear selection in the present study, therefore, does not probably cause systematic discrepancies in calculated lengths of the Castellorizo Island parrot fish. Also, the fishery for parrot fish in the area is probably not intensive enough to remove significant numbers of the faster growing fish.

5. GROWTH IN WEIGHT

Covariance tests indicated that all data taken prior to and during or after spawning could be pooled into one regression. Log plots revealed no difference between the sexes in the weight-length relationship. Since the length and weight data showed no consistent sex maturity or season differences, data from 228 fish were combined for the determination of the general length-weight relation.

The general length-weight equation determined by fitting a straight line to the logarithms of length and weight was:

$$\log W = 3,05 \log L - 4,92$$

where W is the weight in g and L the total length in mm. The correlation coefficient (r) was 0.975, indicating high degree of relationship and predictability between length and weight.

6. REPRODUCTION

Almost 185 parrot fish were examined to determine the period of apparent peak reproductive activity. A single reproductive pulse occurred in July-August and declined steadily until October. Maturity is defined, for females, as when the oocytes are fully developed and, for males, when the testes exude milt. The female mature at age I+, while the male reaches sexual maturity two years later (Figure 2). Since 74.3% of the fish between the III and IX age groups in this area are male, they will suffer a higher fishing mortality from trammel bottom nets, but the corresponding sex ratio indicates a much greater mortality in the female population. The lack of large female fish could be attributed to greater natural mortality, or to a decrease in growth rate after maturity (Nikolski, 1975); this would result in the females remaining in the size range and vulnerable to trammel bottom nets for a larger period of time.

The available evidence on the growth of females does suggest a decrease in growth rate in later years, but the sample size is not large enough to reach any firm conclusion.

TABLE 1

Average calculated total length and annual growth increments
of 214 parrot fish from Castellorizo Island

Age Class	Number of fish	Mean	calculated total					length at the					end of the			Average observed length (mm)
			I	II	III	IX	V	VI	VII	VIII	IX	year				
I	75	126.3													152	
II	95	126.6	167.1												177	
III	27	124.4	164.9	197.9											209	
IV	3	129.7	165.2	196.8	220.0										230	
V	8	124.3	163.6	199.1	221.0	241.3									248	
VI	4	126.9	165.5	200.1	226.4	251.4	268.6								274	
VII	--	0	0	0	0	0	0	0							-	
VIII	1	121.9	167.3	190.0	212.7	232.2	251.6	264.6	280.8						286	
IX	1	139.9	169.6	192.7	209.2	235.6	255.6	268.6	285.1	295.0					295	
Total number		214	139	44	17	14	6	2	2	1						
Average calculated length (mm)		126	166	198	221	243	264	267	283.0	295.0						
Length increment(mm)		126	40	32	23	22	21	3.0	16	12.0						

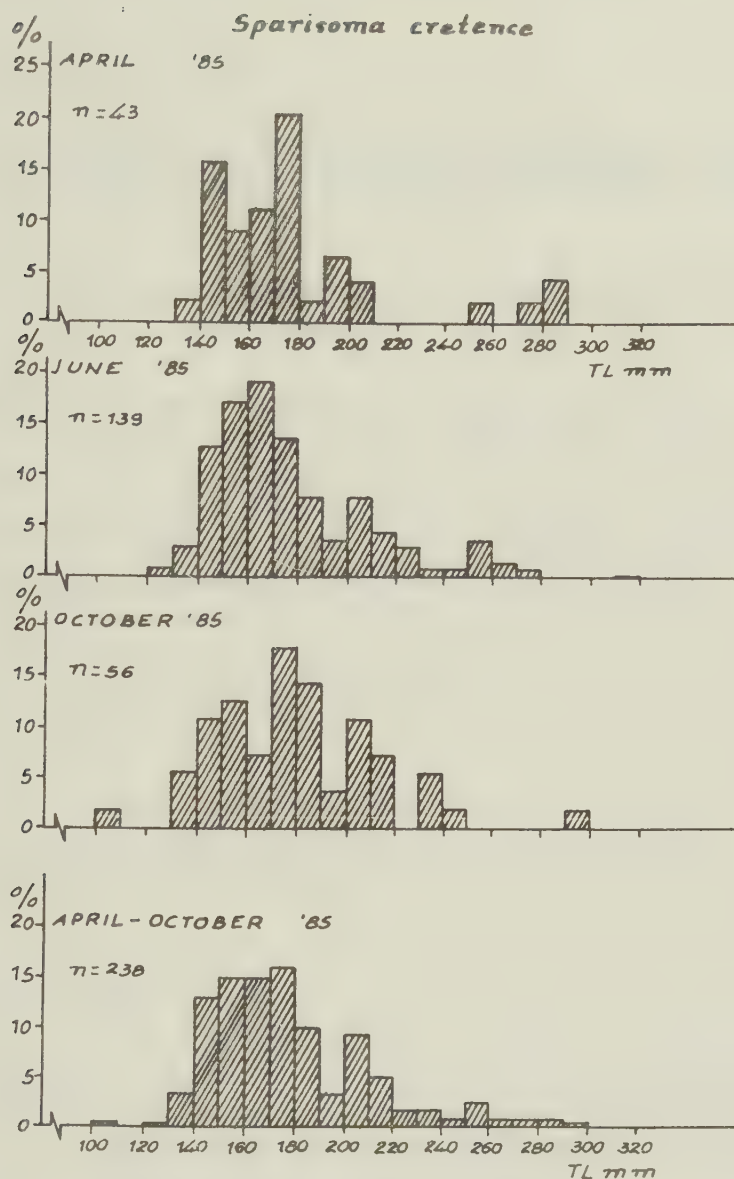


Figure 1 - Length frequency distribution of parrot fish caught by trammel bottom nets (239 fish) during the period April-October 1985 in the Castellorizo Island

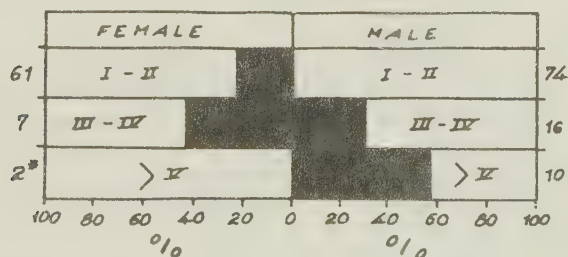


Figure 2 - Size at maturity of parrot fish in Castellorizo Island. Percentage of females and males mature (gonadal stages IV, solid bar) or immature (gonadal stages III, white), by respective age in years are shown. Sample sizes are on the left (females) and right (males)

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ANNEX(E) K

Production of Cephalopods in Greek waters, 1928-81

by

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1. INTRODUCTION

Nowadays, with the increasing demand for proteins, the total world stock of cephalopods which has been estimated to be well over 70 million t (Voss, 1973^{1/}; Worms, 1979^{2/}), might represent a new protein source. The annual world catch of cephalopods, however, amounts only to two million t, making up approximately 3% of the annual world catch ^{3/}. Cephalopods have long been exploited in the Mediterranean Sea, especially in the western part, with a mean (1964-74) annual catch of 44,000 t (Worms, 1979), which falls within the limits of the total potential production of cephalopods of 30,000-60,000 t (FAO, 1981^{4/}), in the Mediterranean Sea.

In the present work, the fishery of cuttlefish (class Sepioidea), squids (class Teuthoidea) and octopods (class Octopoda) in Greek waters during 1928-81 is reviewed, and a comparison of the landings for the years before and after the war is attempted.

2. MATERIAL AND METHODS

Catches of cuttlefish, squids and octopods in Greek waters have been recorded on a monthly basis since 1928, with a gap in the record between 1940 and 1963 (Greek Fisheries Statistics, 1934-40^{5/}; National Statistical Service of Greece, 1968-83^{6/}). Data on fishery landings were collected for each fishing vessel separately, through the local custom authorities.

^{1/} Voss, G.L., Cephalopods resources of the world. FAO Fish.Circ., No. 149. 1973

^{2/} Worms, J., L'exploitation des cephalopodes en Mediterranée: évolution et perspectives. Rapp.Comm.int.Mer Medit., 25/26, 10:pp. 169-84 1979

^{3/} Approx. 2% of world marine catch in 1980: Worms, J., 1983. World fisheries for Cephalopods: A synoptic Overview. P. 1-20 in J.F. Caddy (ed.) 1983. Resources in assessment of world cephalopod resources. FAO Tech.Pap. 231:452 p.

^{4/} FAO, Atlas of the living resources of the sea. FAO Fisheries Series, Rome 1981 1981

^{5/} Greek Fisheries Statistics, Ministry of National Economy, General Statistical Service of Greece. Section B, 7 issues 1934-40

^{6/} National Statistical Service of Greece, Results of the sea fishery survey by 1968-83 motor vessels, for the years 1964-81. Section G, 13 issues

3. RESULTS

The catches of cuttlefish, squid and octopods for 1928-39 are tabulated in Table 1. Six thousand tons of cephalopods were landed during 1928-39, all of which were caught in Greek waters. The average 1928-39 annual cephalopod catch was 498 t. Octopods predominated the landings, representing 53.8% (268.1 tons), whereas squids and cuttlefish shared 13.5% (67.2 tons), and 32.7% (162.7 tons) of the mean annual yield respectively. A long-term increase in the catches of cuttlefish, squids and octopods took place from 1928 to 1939 (Table 1).

The total harvest of cephalopods in 1964-81 amounted to 94,267 tons, 35,936 tons (36.1%) of which were fished in Greek waters and 58,331 tons (63.9%) in the Atlantic Ocean and off the north African coast (Table 2). The mean annual cephalopod catch for 1964-81 was 1,997 tons. Octopods comprised the major part of the catch, with a proportion of 43.2% (863.1 tons), whilst squids (common squid and flying squid) and cuttlefish represented 27.2% (541.9 tons) and 29.6% (591.5 tons) of the mean annual catch respectively.

The relative proportion of squid, cuttlefish and octopods in the catches changes considerably with time (Table 2). It ranged between 9.2% (1969) and 24% (1978) for common squid, between 5% (1966) and 19.3% (1973) for flying squid, between 36.9% (1977) and 51.3% (1965) for octopods, and between 21.9% (1972) and 36.4% (1967) for cuttlefish.

The catches of cephalopods fluctuate greatly with time (Figure 1); with those of squids varying between 187.8 tons (1969) and 593.6 tons (1978), those of octopods between 637 tons (1973) and 1,059 tons (1965), those of cuttlefish from 344.3 tons (1972) to 774.6% (1978), and those of flying squids from 93.3 (1966) to 317.3 (1973). In general, the landings of common squid, cuttlefish and octopods declined from a peak in the mid 1960s to a low in the early 1970s, rose again to a maximum sometime in 1977-78, followed by a downward trend in the early 1980s. The total cephalopod catch exhibited a similar pattern of variation. The flying squid catches, on the other hand, exhibited an opposite trend to that of common squid, cuttlefish and octopods.

4. DISCUSSION

The cephalopod catch in 1964-81 is four times the pre-war mean, which can be attributed to the rise in fishing effort. For instance, the mean annual number of trawlers and seiners was 575 in 1928-39 (Table 1), and 1,151 in 1964-81. The improved efficiency of fishing equipment in recent years and the length of the fishing season also probably contributed to this increase.

The mean 1964-81 catch of cephalopods (1,997 tons) represents 3.4% of the total yield (fish, cephalopods, crustaceans and bivalves) fished in Greek waters (58,950 tons). It comprises 4% of the mean annual Mediterranean cephalopod catch

[=44,000 tons (Worms, 1979)^{1/}], whereas it is three times higher than that of the Levantine basin [=623 tons (Worms, 1979)] and 15.4% of that for the Adriatic Sea cephalopod catch [=12,900 tons (Worms, 1979)].

The fluctuations in the catches during 1964-81 are probably related to fishing effort, as revealed by the oscillations in the number of trawlers, seiners and total number of boats involved in the inshore Greek fishery (seiners and "other boats", small ring netters, small drifters and liners, etc.) (Figure 2). Trawlers, "other boats" and seiners contributed about 50%, 40% and 10% of the total cephalopod yield respectively till 1969, when the number of the "other boats" drastically decreased due to the fact that "other boats" (and corresponding catches) with a horsepower less than 20 HP are not recorded from 1970 onwards and the contribution of the trawlers rose to about 80%. The number of "other boats", however, gradually increased from 1970 onwards (Figure 2). The curve for the seiners paralleled those of cuttlefish and octopods. The number of trawlers, on the other hand, decreased from 1964 to 1968, increased up to 1975, and declined again to stable levels in the late 1970s-early 1980s. It seems, therefore, that the decline of the catches in the 1970s is mainly the result of a concurrent decrease in the number of boats involved in the inshore fishery (Figure 2).

It is difficult, however, to isolate the anthropogenic effect from that of natural changes. There is no doubt that changes in the marine climate drastically affect the distribution, abundance and reproduction of planktonic, benthonic and nektonic organisms. There is a plethora of studies concerning the biological responses to marine climatic change. For instance, ICNAF Special Publication No. 6 (1965; 914 pages) was dedicated to the effect of environmental changes on marine populations in both the Atlantic and Pacific Oceans. Indications are that changes in the abundance of octopods, cuttlefish and squids are closely associated with the fluctuations of temperature in Greek waters (Stergiou, unpublished data).

Unfortunately, there has been no systematic survey concerning climatic variations and catch per unit of fishing effort of marine populations in eastern Mediterranean waters. Considering also that this area is characterized by very low levels of primary and secondary production, this strongly reveals the necessity for monitoring the Eastern Mediterranean Sea on a monthly (or annual) basis for changes in the marine environment, both physical (temperature, salinity, currents, etc.), and biological (distribution, catch per fishing effort, reproductive period, extent of spawning beds, distribution and abundance of larvae, etc.). This will ultimately contribute to the assessment of the relative impact of natural and anthropogenic changes on marine populations and, hence, to a rational management of Eastern Mediterranean fishery resources.

^{1/} 31,600 t in 1980: Worms, 1983

Table 1
Annual catches, in metric tonnes, of squids, octopods and cuttlefish in Greek waters, and total number of trawlers and seiners, 1928-1939.

Year	Squids	Octopods	Cuttlefish	Boats
1928	15.9	65.8	100.2	449
1929	34.9	200.5	85.4	696
1930	32.7	209.7	125.2	555
1931	26.0	221.2	140.6	638
1932	36.5	194.5	111.2	665
1933	32.1	229.8	141.8	543
1934	84.4	230.1	119.1	518
1935	78.8	253.7	121.7	500
1936	76.9	421.1	171.9	627
1937	86.5	505.5	225.1	611
1938	145.1	380.8	334.6	665
1939	156.8	300.4	275.6	582
Total	806.6	3217.6	1952.4	
Mean	67.2	268.1	32.7	574
%	13.5	53.8	32.7	

Table 2
Annual Greek catches, in metric tonnes, of cephalopods, and proportions of common squids, flying squids, octopods and cuttlefish, 1964-1981.

Year	Total ¹	Total ²	Squid	Octopod	Cuttlefish	Flying Squid
1964	4597.4	1829.1	14.0	44.5	34.6	6.9
1965	6622.8	2066.2	11.1	51.3	31.0	6.7
1966	4958.7	1868.1	13.0	49.6	32.4	5.0
1967	4715.7	1837.8	12.9	42.1	36.4	8.6
1968	5651.9	1941.6	11.9	46.8	33.1	9.7
1969	7177.5	2050.6	9.2	45.1	31.5	14.0
1970	5421.3	1659.2	12.9	45.2	25.3	16.5
1971	6415.5	1705.6	11.8	48.0	22.9	17.6
1972	5577.9	1575.5	13.5	46.7	21.9	17.9
1973	5589.7	1641.1	14.6	38.8	27.3	19.3
1974	5598.6	1886.7	18.4	40.4	25.7	15.5
1975	4057.8	2213.2	17.9	41.7	30.7	9.8
1976	4962.8	2244.6	21.0	37.0	34.0	8.1
1977	4698.6	2148.0	21.2	36.9	33.7	8.3
1978	4141.4	2473.4	24.0	37.1	31.5	7.4
1979	6337.3	2315.9	22.1	42.9	27.1	8.0
1980	4072.1	2231.7	19.1	45.6	26.6	8.9
1981	3670.0	2248.3	21.6	42.4	25.0	11.1
Total	94267.0	35936.0				
Mean	5237.1	1997.0				
%	100	36.1	16.4	43.2	29.6	10.8

1= total catch fished in Greek waters, Atlantic ocean and North African coast

2= total catch fished in Greek waters

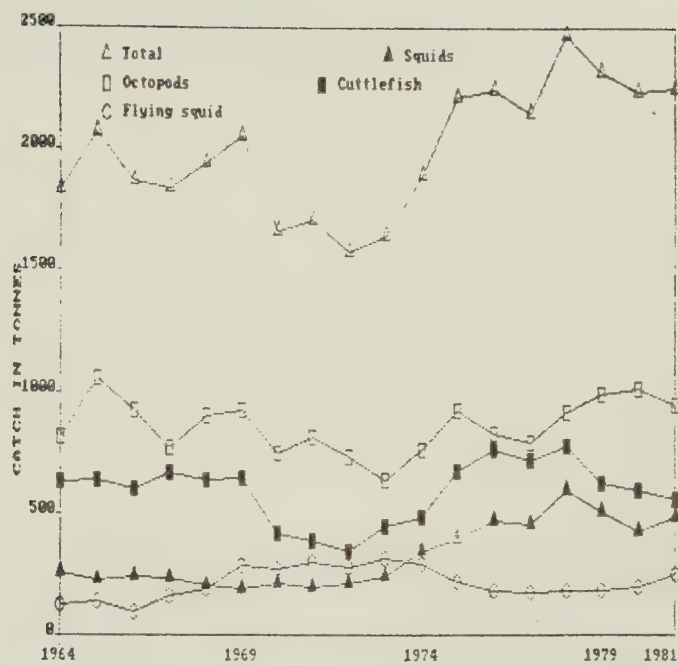


Figure 1. Annual catches of cephalopods, squids, flying squids, octopods and cuttlefishes in Greek waters, 1964-81

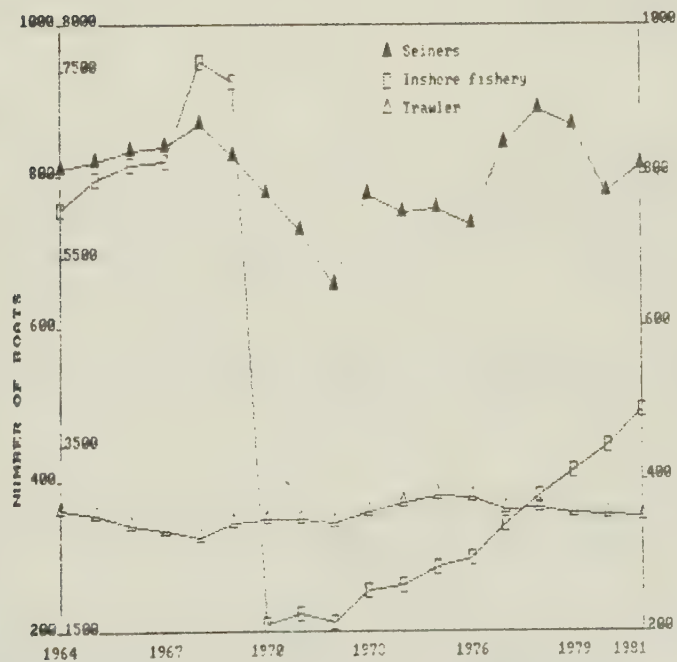


Figure 2. Number of trawlers, seiners and total number of boats involved in the Greek inshore fishery, 1964-81

ANNEX(E) L

Preliminary study on the diet of *Pagrus pagrus*,
Phycis phycis and *Siganus rivulatus* in the
Kastellorizo waters, Eastern Mediterranean
Greece

by

E. Karagitson, K. Stergiou and C. Papaconstantinou

1. INTRODUCTION

Although the literature pertaining to the trophic niches of fish is very poor (Livingston, 1985),^{1/} studies on feeding relationships among species hold a key in ecosystem research, inasmuch as, coupled with studies on the environment, they lead to the construction of ecological models that can provide a quantitative view of species interactions and enable us to make decisions in multispecies management.

In the present work, carried out in the framework of the fisheries investigations in Greek waters, information pertaining to the trophic niche of three commercial fish species, red porgy (*Pagrus pagrus*), saloubardos (*Phycis phycis*) and rabbitfish (*Siganus rivulatus*), from Kastellorizo Island, Eastern Mediterranean, Greece, is presented. These species accounted for 35% of the total bottom trammel net and hook and line catches in the region. The literature with regard to the feeding habits of these fishes is very poor, limited to information on the aquaculture of rabbitfish (Ben-Tuvia, Kissil and Popper, 1973)^{2/}, and to the diet of red porgy in North and South Carolina, USA (Bearden and McKenzie, 1969; Manooch, 1977)^{3/}.

2. MATERIAL AND METHODS

Digestive tracts of 91 red porgy, 89 rabbitfish and 165 fork-beard, with total length ranging between 13,4-40,9 cm, 70-160 cm and 16.6-48.4 cm respectively, were collected by trammel bottom nets and hook line around Kastellorizo during three seasonal cruises from April to October 1985.

The length, weight, sex and maturity stages were determined in the field, and stomachs and intestines were extracted and preserved in 6% formalin.

^{1/} Livingston, A.P., An ecosystem model evaluation: the importance of fish
1985 food habits data. Mar.Fish.Rev., 47(1):pp.9-12

^{2/} Ben-Tuvia, A., Kissil, G.W. and D. Popper, Experiments in rearing rabbitfish
1973 (*Siganus rivulatus*) in sea water. Aquaculture, 1(1):pp. 359-64

^{3/} Bearden, C.M. and M.D. McKenzie, An investigation of the offshore demersal
1969 fish resources of South Carolina. S.C.Wildl.Resour.Dep.Tech.Rep.
No. 2, 19 p.

Manooch, S.C., Foods of the red porgy, *Pagrus pagrus* Linnaeus (Pisces: Sparidae),
1977 from North Carolina and South Carolina. Bull.Mar.Sc., 27(4):pp.776-87

Digestive tract contents were separated taxonomically in the laboratory and weighted to the nearest 0.01 gr. Numbers of each taxon were determined whenever possible, since food items were partially digested and usually crushed. The weight and number of each taxon were then expressed, for each studied species, as a percentage of the total weight (Cw) and number (Cn) of all food items identified, and the frequency of occurrence in relation to the total number of stomachs containing food determined. In addition, the stomach fullness index ($= s \times 10,000/B$; s=weight of stomach contents, B=weight of specimens), and the percentage of the empty stomachs were calculated. The degree of stomach fullness was also estimated arbitrarily by means of the Lebedev's (1946)¹/"point method" ranging from 0 (empty) to 5 (distended).

3. RESULTS

3.1 Feeding intensity

The intensity of feeding is negatively related to the proportion of empty stomachs, and positively associated with the degree and index of fullness. The relatively high degree and index of fullness and the low percentage of empty stomachs, for all three species examined (Table 1), both suggest that feeding intensity is high, which, in turn, suggests that food is probably not a limiting factor to the abundance of the species concerned.

3.2 Feeding habits

3.2.1 Rabbitfish

Algae, representing 20 genera and contributing 78.3% by weight, as well as diatoms, hydrozoa, detritus and sand were identified (Table 2, Figure 1). Although diatoms (mainly epiphytic) were present in all stomachs examined, they shared an insignificant part of the total weight. Copepods, occurring with a frequency of 1%, and sand were thought to be ingested incidentally. As seen from Figure 1, Dictyota, Sphacellaria, Cystoceira and detritus were the dominant food items by both weight and frequency of occurrence. In addition, hydrozoa, Padina and Kallymenia occurred in the diet with a frequency higher than 15%.

3.2.2 Red porgy

Forty taxa of trophic items were identified in the red porgy stomachs examined. Seventy-four percent of the food of the adult red porgy was composed of obligate benthic invertebrates (mainly Pagouridae, Maiidae and Echinoidea)

¹/ Lebedev, N.V., Elementary population of fish. Zoologicheskii Zhurnal, 25(2): 1946 pp. 121-35

whereas 28.9% by weight was composed of fish (Table 3, Figure 2). Algae, occurring with a frequency of 0.7%, was considered as ingested incidentally. Fish, brachyura and anthozoa dominated the red porgy diet by weight with percentages of 28.9%, 21.3% and 17.3% respectively, while decapoda and echinoidea were of secondary importance (8.5% and 6.7%). Decapoda, on the other hand, predominated by number (45.5%), whereas achinoidea, gastropoda and polychaeta shared a lower portion of the total number of trophic items (12.7%, 11.5% and 10.9%). With regard to the frequency of occurrence, decapoda, fish, anthozoa and polychaetes dominated with percentages of 45.8%, 33.8%, 31.3% and 30.1% respectively.

3.2.3 Fork-beard

In general, 50 taxa of trophic items were identified of which fish and obligate benthic invertebrates comprised the 54.8% and 45.2% by weight respectively (Table 4). Algae made up an insignificant part by weight and was considered as ingested incidentally. As it is shown from Table 4 and Figure 3, fish, decapoda (Alpheidea, Palaemonidea) and brachyura (Portunidea) are the predominant food items in the diet by weight (54.8%, 26.7% and 12.6%), number (10.4%, 52.2% and 15.4%) and frequency of occurrence (36.7%, 70.7% and 17.3%).

4. DISCUSSION

A comparison of Tables 1 through 3 clearly shows that the trophic niches of red porgy, rabbitfish and fork-beard differ radically from each other.

Rabbitfish is a primarily herbivore species, preying mainly upon Dictyota, Sphacellaria and Cystoseira. Red porgy and fork-beard, on the other hand, are carnivores, feeding on different trophic levels than that of rabbitfish. In addition, the trophic niche of the red porgy is totally differentiated from that of fork-beard. The latter preys primarily upon fish and decapoda, while the red porgy feeds mainly on fish and anthozoa. Certain morphological characteristics aid the red porgy and fork-beard in feeding. Both are fast to chase motile organisms (e.g. fish) and possess strong jaws with pronounced teeth in order to crush non-motile or less motile organisms armored with exoskeleton for protection (e.g. brachyura). In any case, the taxa identified in the red porgy diet are completely different than those of fork-beard, which agrees well with the ecology of the two species. Red porgy is an opportunistic predator, as opposed to fork-beard which is an obligate raptorial predator.

Moreover, the ability of these fish to switch between feeding on the second (various invertebrates) and third trophic level (various fishes), has definite selective advantages for both species in inhabiting the coastal waters since they do not depend on one or few specific food items as the source of energy. This may explain the high abundance of these species in the area in concern.

TABLE 1. Number of stomachs, percentage of empty stomachs, degree and index of fullness for each species examined

	Rabbitfish	Red porgy	Fork-beard
Examined stomachs	89	91	165
Empty stomachs	1	8	15
% empty stomachs	1.12	8.8	9.1
Degree of fullness	3.2	3.2	3.0
Index of fullness	121.3	91.4	86.4

TABLE 2. Composition of the rabbitfish diet by major group from the Kastellorizo area between April-October 1985

FOOD ITEMS	f%	Cw
CHLOPHYCEA		
Anadyomena	2.35	0.32
Valonia	1.18	0.11
Cladophora	1.18	0.41
Pseudochlorodesmium	3.53	0.47
Dasycladus	1.18	0.36
PHAEOPHYCEAE		
Cystoseira	52.94	7.99
Dictyopteris	10.59	0.44
Dictyota	97.65	42.95
Dilophus	10.59	2.25
Sphacelaria	84.71	12.79
Kuckuckia	1.18	2.15
Padina	15.29	2.28
RHODOPHYCEAE		
Kallymenia	15.29	1.07
Champia	8.24	0.45
Gelidium	4.71	3.41
Chondria	3.53	0.13
Rutiflea	2.35	0.07
Polysiphonia	2.35	0.81
Botrycladia	2.35	0.16
Rodymenia	1.18	0.03
DIATOMA	100.00	-
COPEPODS	1.18	-
HYDROZOA	27.06	0.66
DETRITUS	95.29	12.67
SAND	65.88	3.98
NON IDENTIFIED	-	4.68

TABLE 3. Composition of the red porgy diet by major group from the Kastellorizo area, between April-October 1985

FOOD ITEMS	F%	Cw%	Cn%
ALGE	4.8	0.5	-
ANTHOZOA	31.9	17.3	-
PORIFERA	3.6	0.2	1.2
POLYCHAETA	30.1	4.2	10.9
OSTRACODA	1.2	0.01	1.2
ISOPODA	2.4	0.7	-
AMPHIPODA	1.2	0.02	1.2
DECAPODA	45.8	8.5	45.5
BRACHYURA	20.5	21.3	6.7
GASTROPODA	16.7	0.8	11.5
BIVALVIA	7.2	1.8	3.6
ECHINOIDEA	20.5	6.7	12.7
OPHIUROIDEA	1.2	0.02	1.8
CEPHALOPODA	1.2	2.9	1.2
FISHES	33.8	28.9	4.2
DIGESTED FOOD	16.9	6.4	-

TABLE 4. Composition of the fork beard diet by major group from the Kastellorizo area between April-October 1985

FOOD ITEMS	F%	Cw%	Cn%
ALGE	0.7	-	-
ANTHOZOA	4.0	0.06	0.2
OSTRACODA	2.7	0.4	15.4
ISOPODA	2.0	0.05	7.1
AMPHIPODA	4.7	0.1	3.3
MYSIDACEA	0.7	0.01	4.16
DECAPODA	70.7	26.7	52.7
BRACHYURA	17.3	12.6	7.1
OCTOBRANCHIA	0.7	0.6	0.2
FISHES	36.7	54.8	10.4
DIGESTED FOOD	13.3	4.6	-

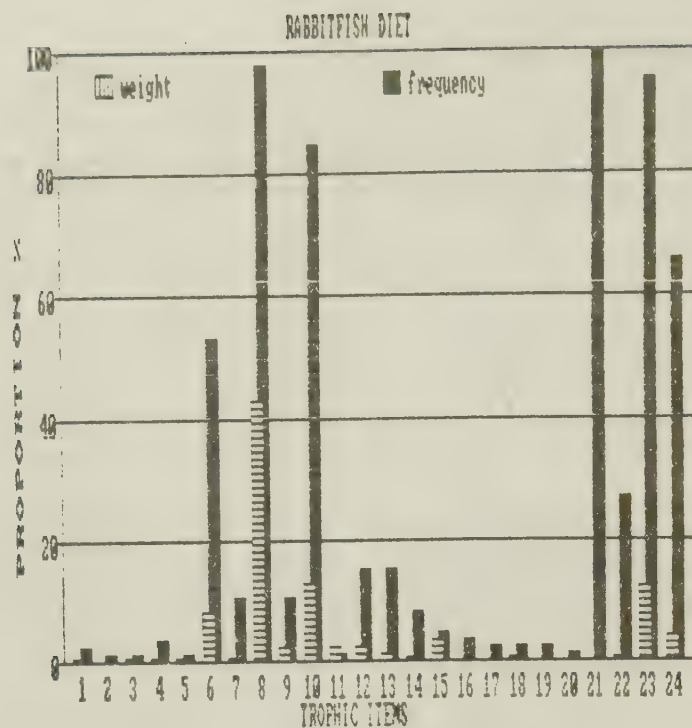


Figure 1. Frequency of occurrence and percentages by weight of food items present in the rabbitfish diet. 1-anadyomena, 2-valonia, 3-cladophora, 4-pseudochlorodesmium, 5-dasycladus, 6-cystoseira, 7-dictyopteris, 8-dictyota, 9-dilophus, 10-sphachelaria, 11-kuckuckia, 12-padina, 13-kallymenia, 14-champia, 15-gelidium, 16-chondria, 17-rutiflea, 18-polysiphonia, 19-botrycladia, 20-rodymenia, 21-diatoma, 22-hydrozoa, 23-detritus and 24-sand.

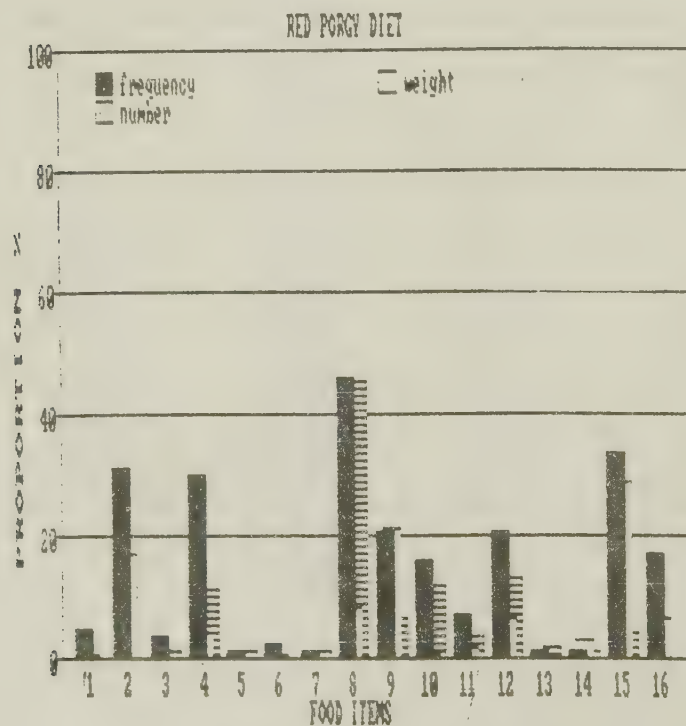


Figure 2. Frequency of occurrence, percentages by weight and number of food items present in the red porgy diet. 1-algae, 2-anthozoa, 3-porifera, 4-polychaeta, 4-ostracoda, 5-isopoda, 6-amphipoda, 7-decapoda, 8-brachyura, 9-gastropoda, 10-bivalvia, 11-echinoidea, 12-ophiuroida, 13-cephalopoda, 14-fishes and 15-digested food.

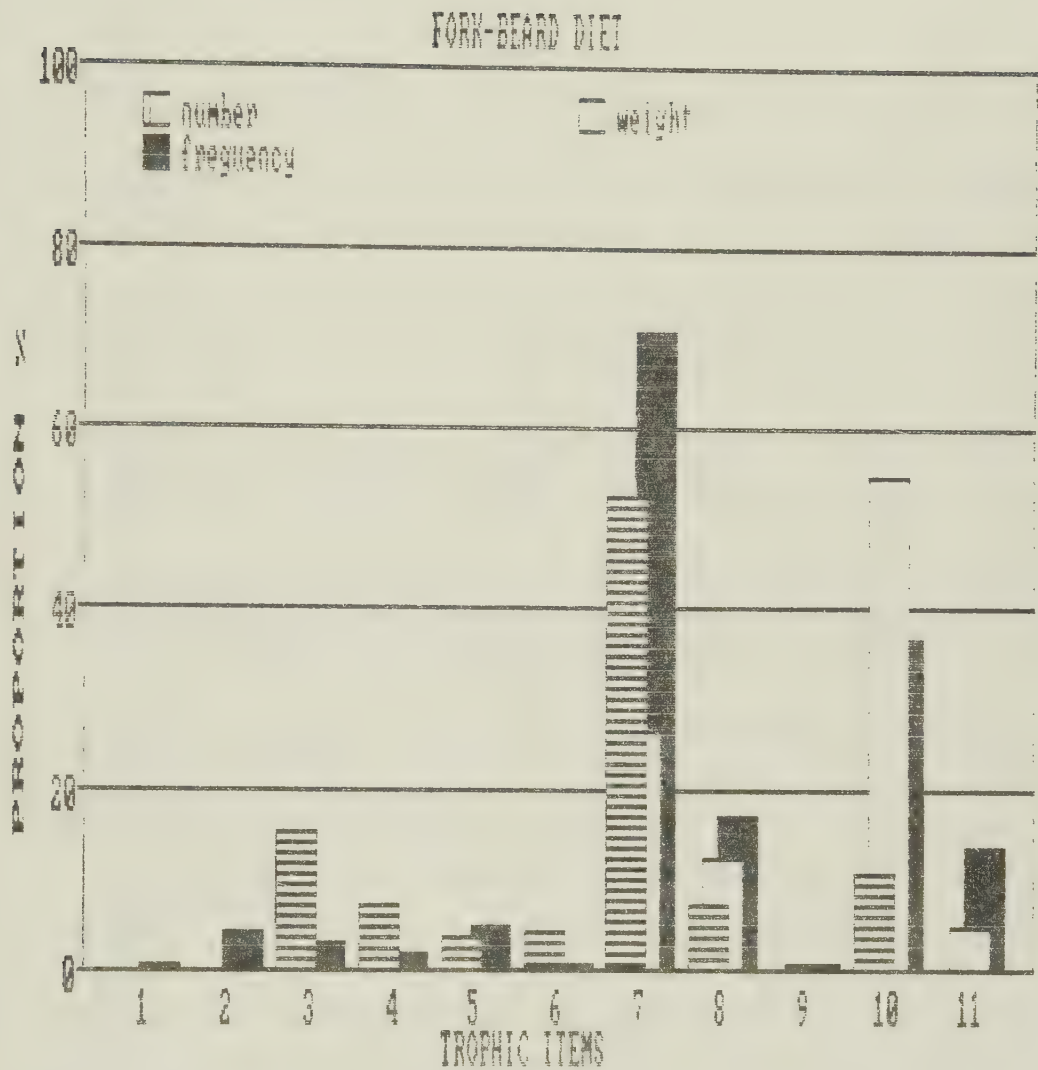


Figure 3. Frequency of occurrence, percentages by weight and number of food items present in the fork-beard diet. 1-algae, 2-anthozoa, 3-ostracoda, 4-isopoda, 5-amphipoda, 6-mysidacea, 7-decapoda, 8-brachyura, 9-octobranchia, 10-fishes and 11-digested food.

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